Armed Forces College of Medicine

AFCM

Pharynx and Larynx

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Lecturer of Anatomy

INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

1. Identify general features of pharynx

2. Enumerate the cartilages of larynx

3. Identify laryngeal ligaments & membranes.

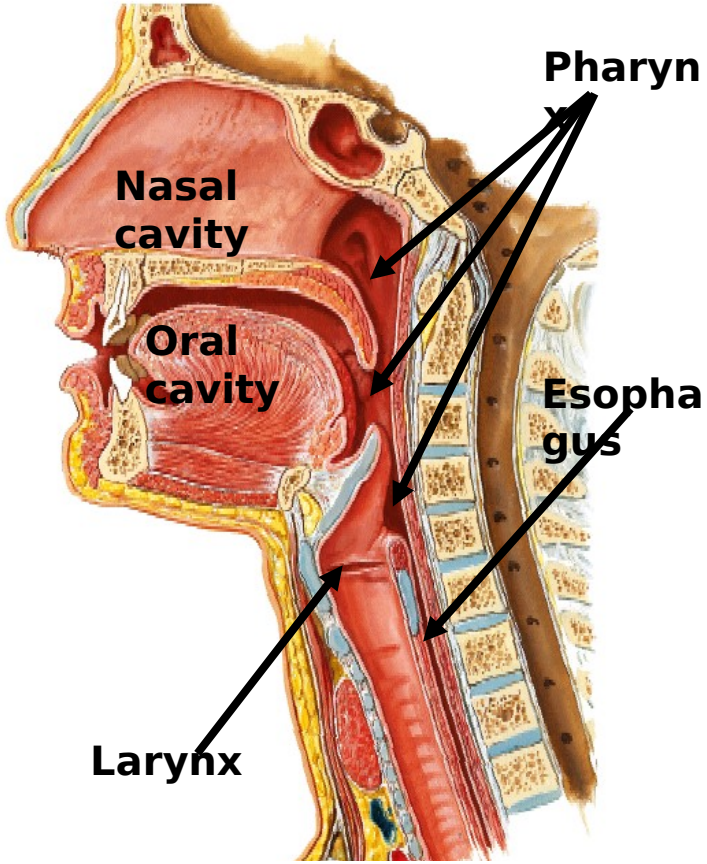
4. Identify laryngeal cavity, boundaries of inlet & rima glottidis.

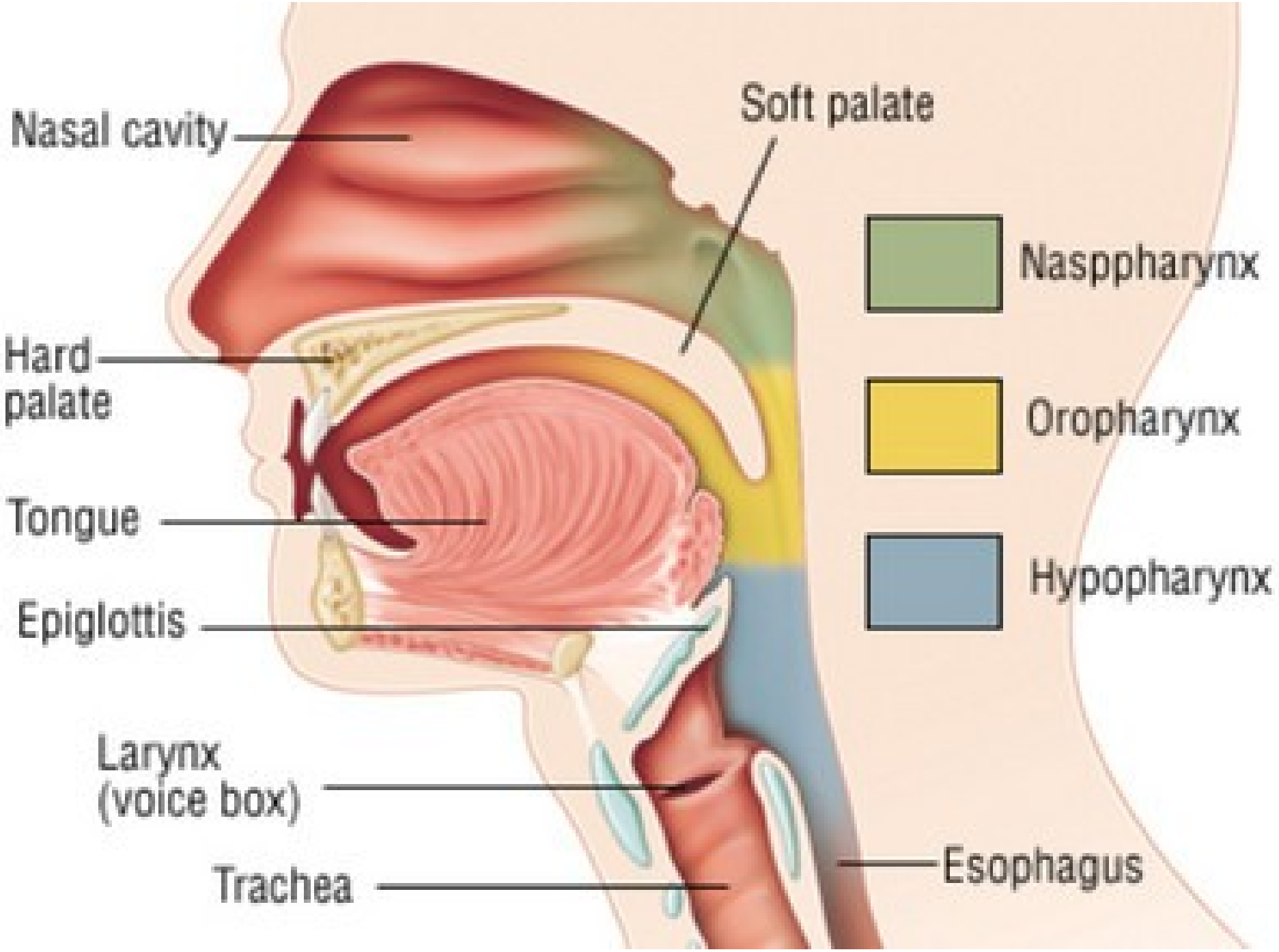
5. State the sensory nerve supply of larynx.

6. Name intrinsic muscles of larynx ,their actions and nerve supply.

Pharynx

- The pharynx is funnel shaped musculofascial tube that links the oral and nasal cavities to the larynx and esophagus.
- **12 – 14** cm long.
- Extends from the **base of the skull** to the level of the **sixth cervical vertebra**.
- The pharyngeal cavity is a common pathway for air and food.




Nasal cavity
Soft palate
Hard palate
Tongue
Epiglottis
Larynx (voice box)
Trachea
Esophagus
Nasppharynx
Oropharynx
Hypopharynx

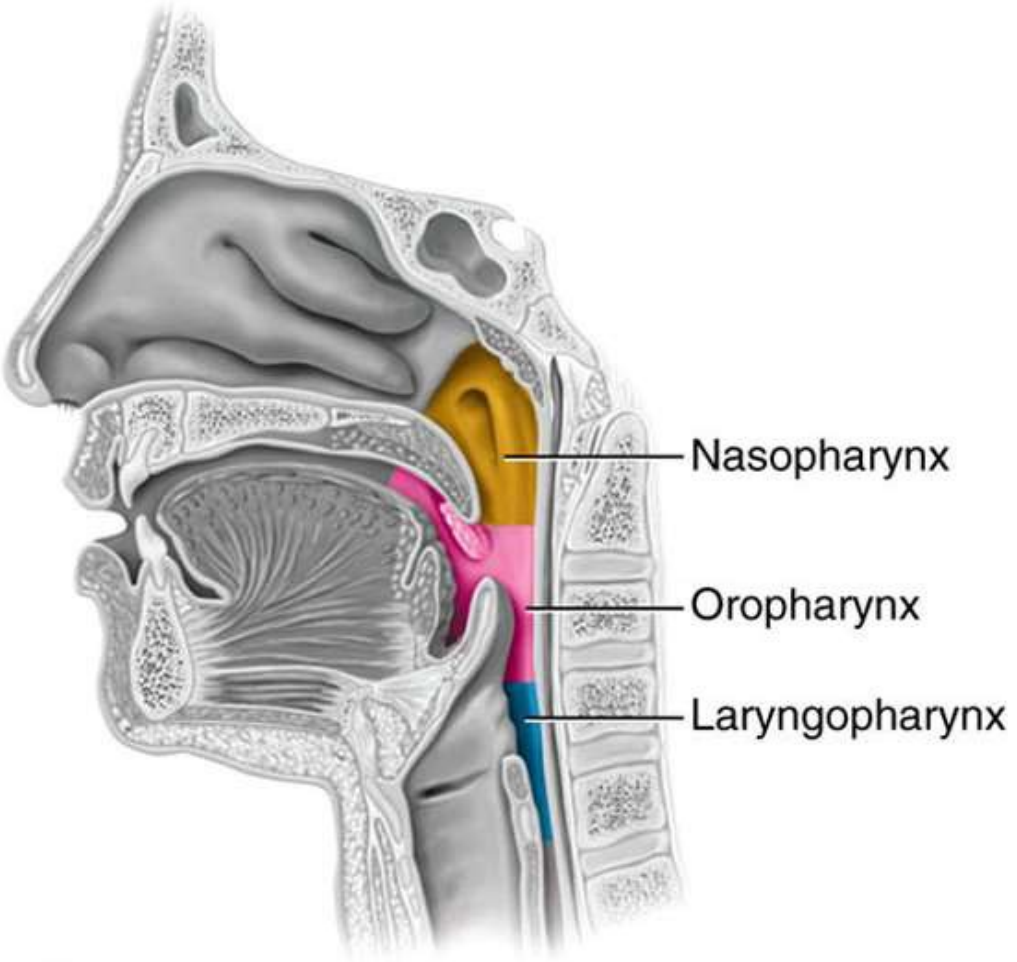
Pharynx

Pharynx is divided into three sections by location:

1. **Nasopharynx:** Posterior to the nasal cavity

2. **Oropharynx:** posterior to the oral cavity.

3. **Laryngopharynx:** posterior to the laryngeal inlet



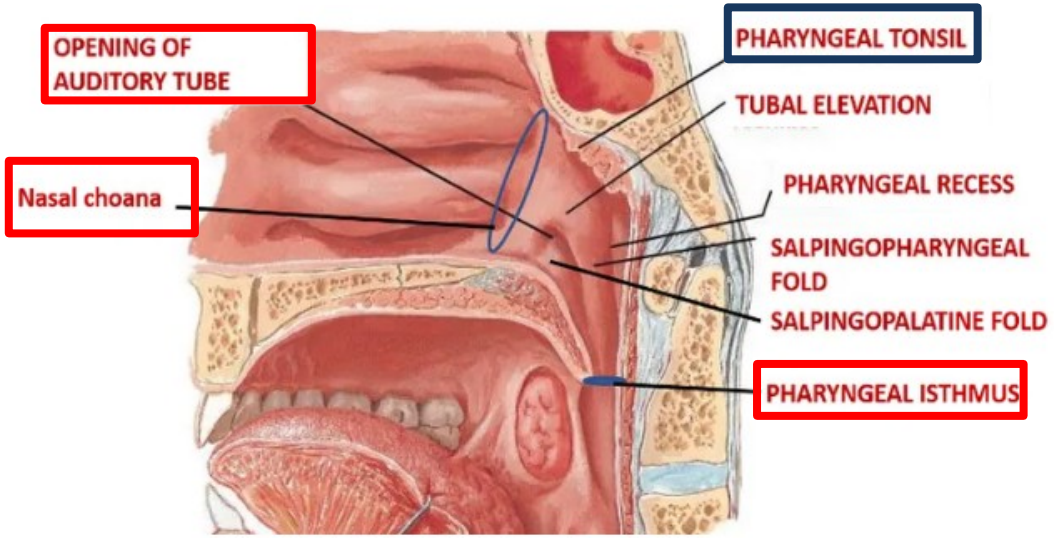
Nasopharynx

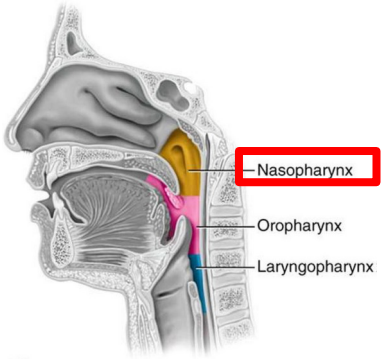
Location:

Posterior to the nasal cavity

Inferior to the body of sphenoid and basilar part of occipital bone

Superior to the soft palate.





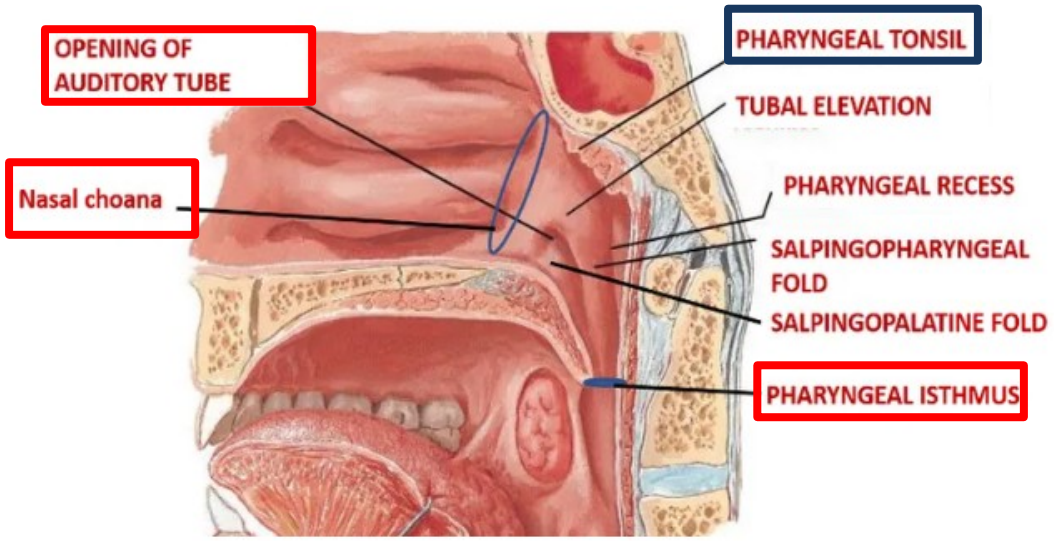
Communicates with:

Anteriorly with **nasal cavity** through *choanae*.

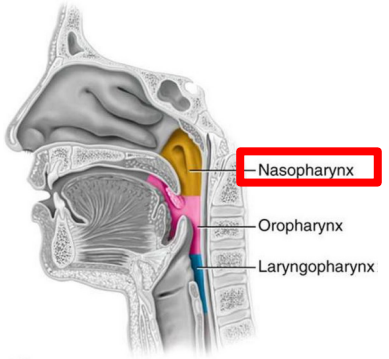
Nasopharynx

Communicates with:

Inferiorly, it becomes continuous with the **oropharynx** behind the soft palate through the *pharyngeal isthmus*.



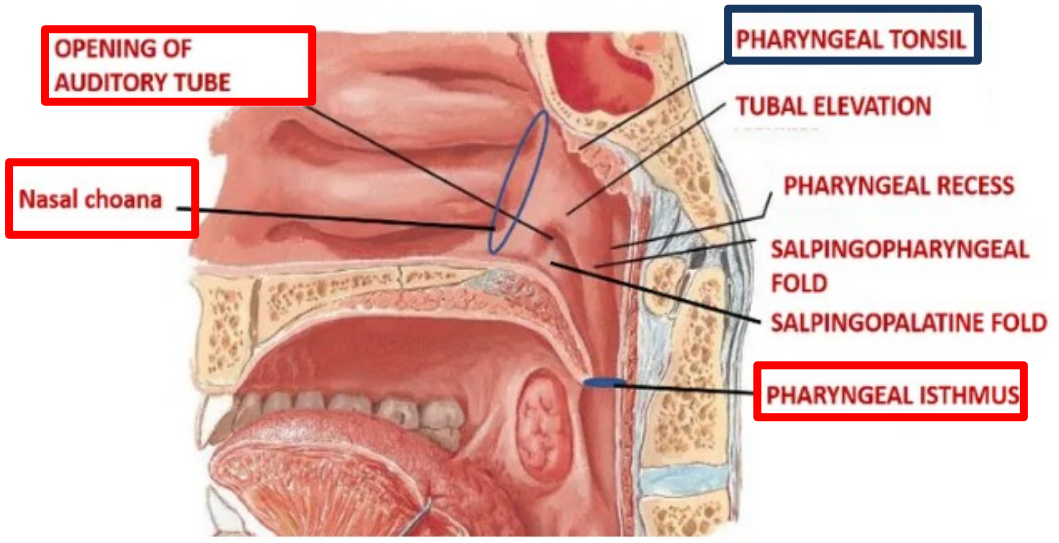
The opening of the *auditory tube* lies on the lateral wall, through which the pharynx communicates with the **middle ear**.

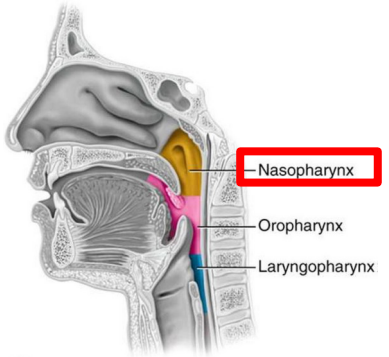


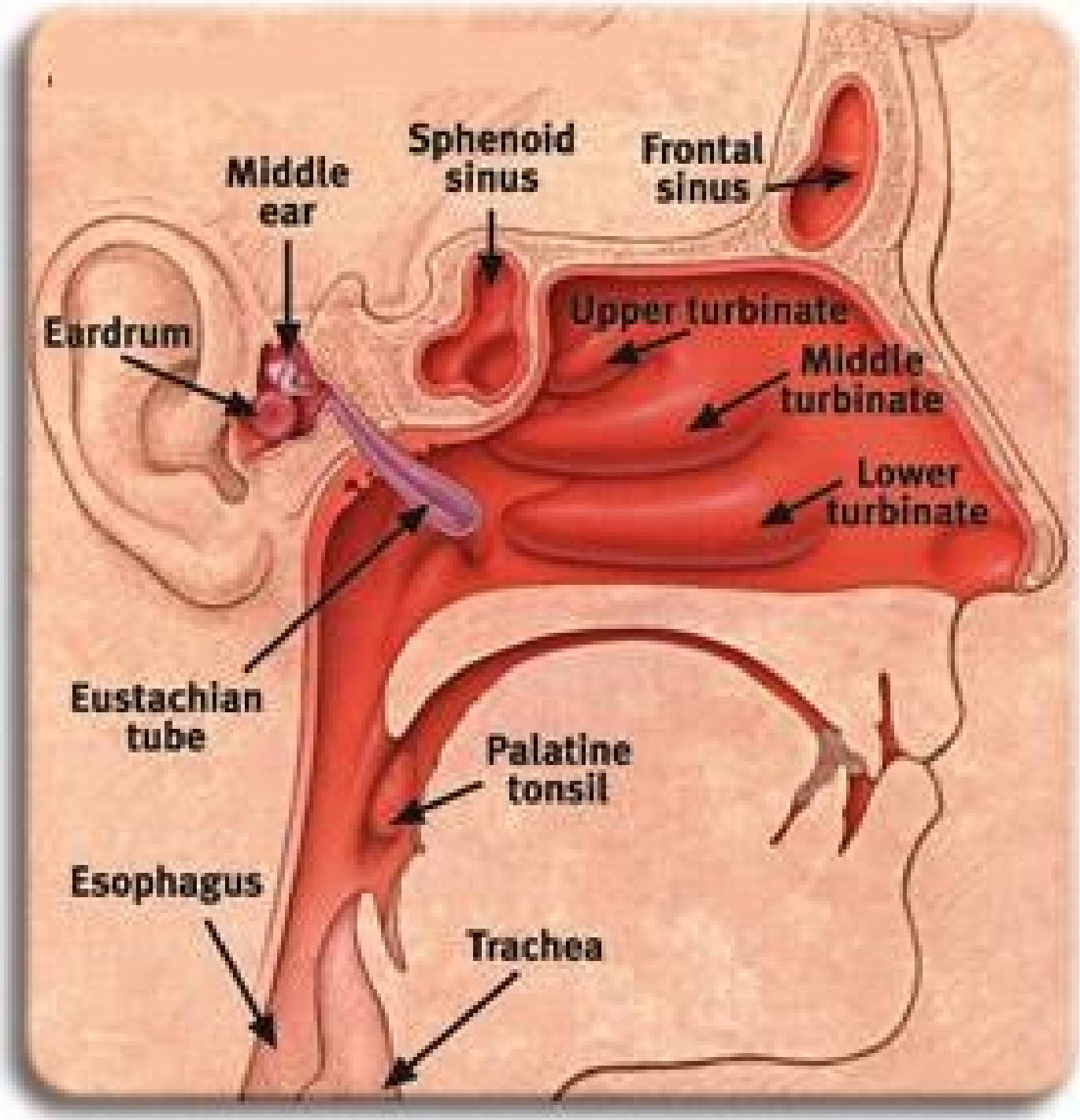
Nasopharynx

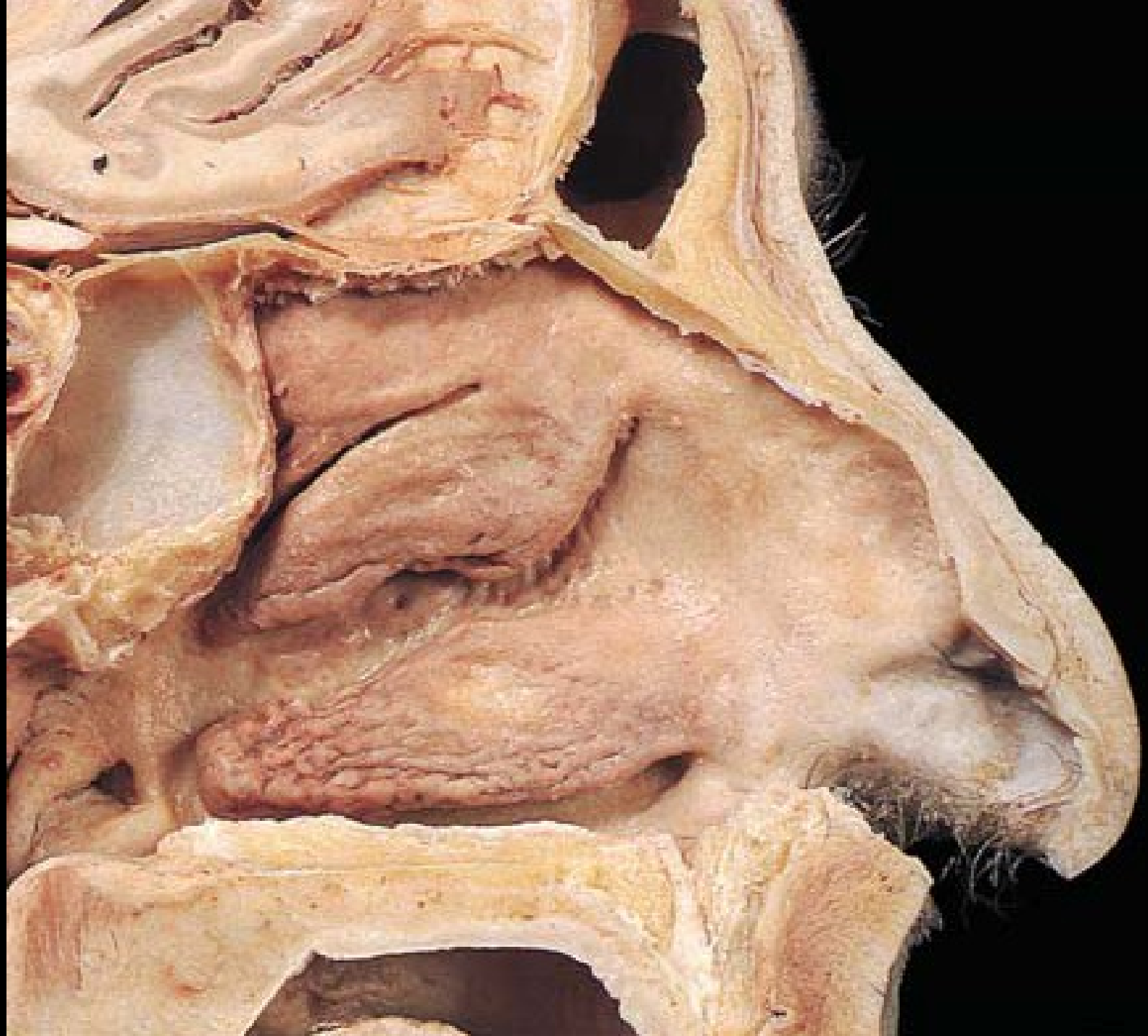
The roof contains a collection of lymphoid tissue called the pharyngeal tonsil (known as **adenoids** when enlarged).

Normally, only air passes through (***Strict airway passage***)






Middle ear
Sphenoid sinus
Frontal sinus
Eardrum
Upper turbinate
Middle turbinate
Lower turbinate
Eustachian tube
Palatine tonsil
Esophagus
Trachea



Nasopharynx

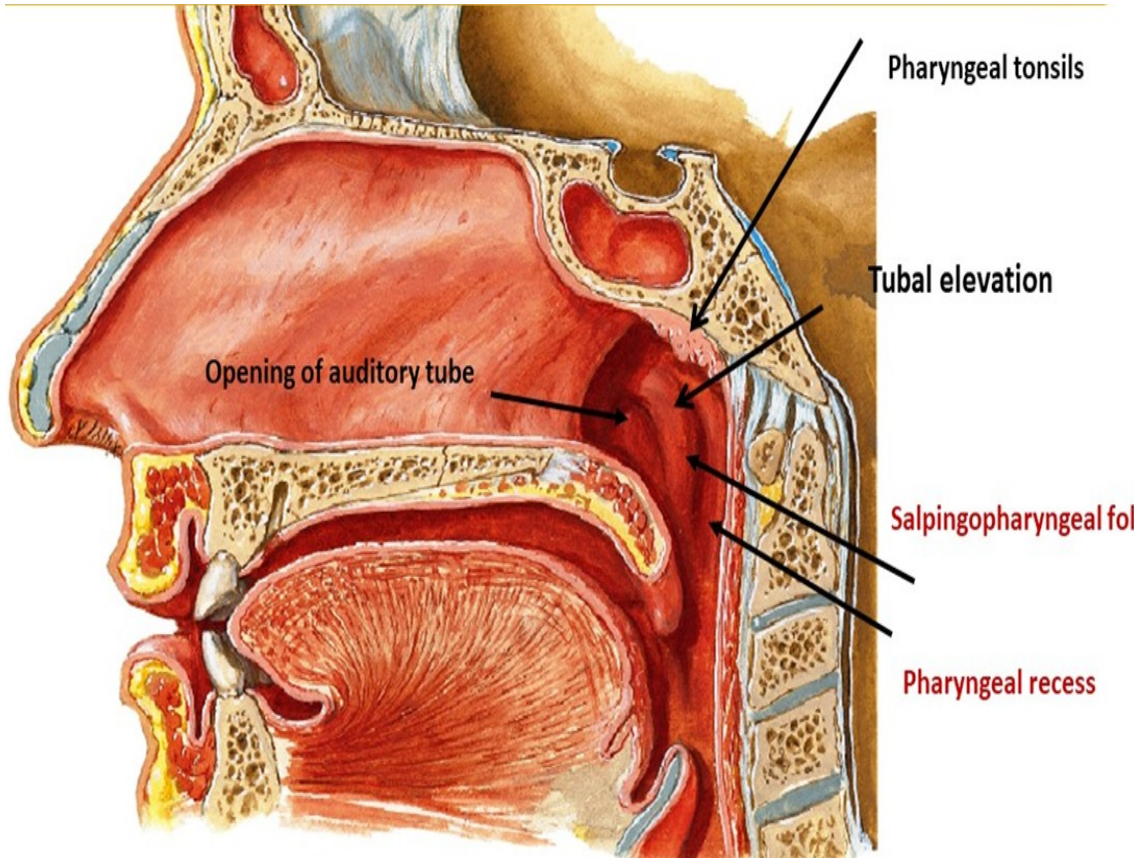
Opening of auditory tube: in lateral wall

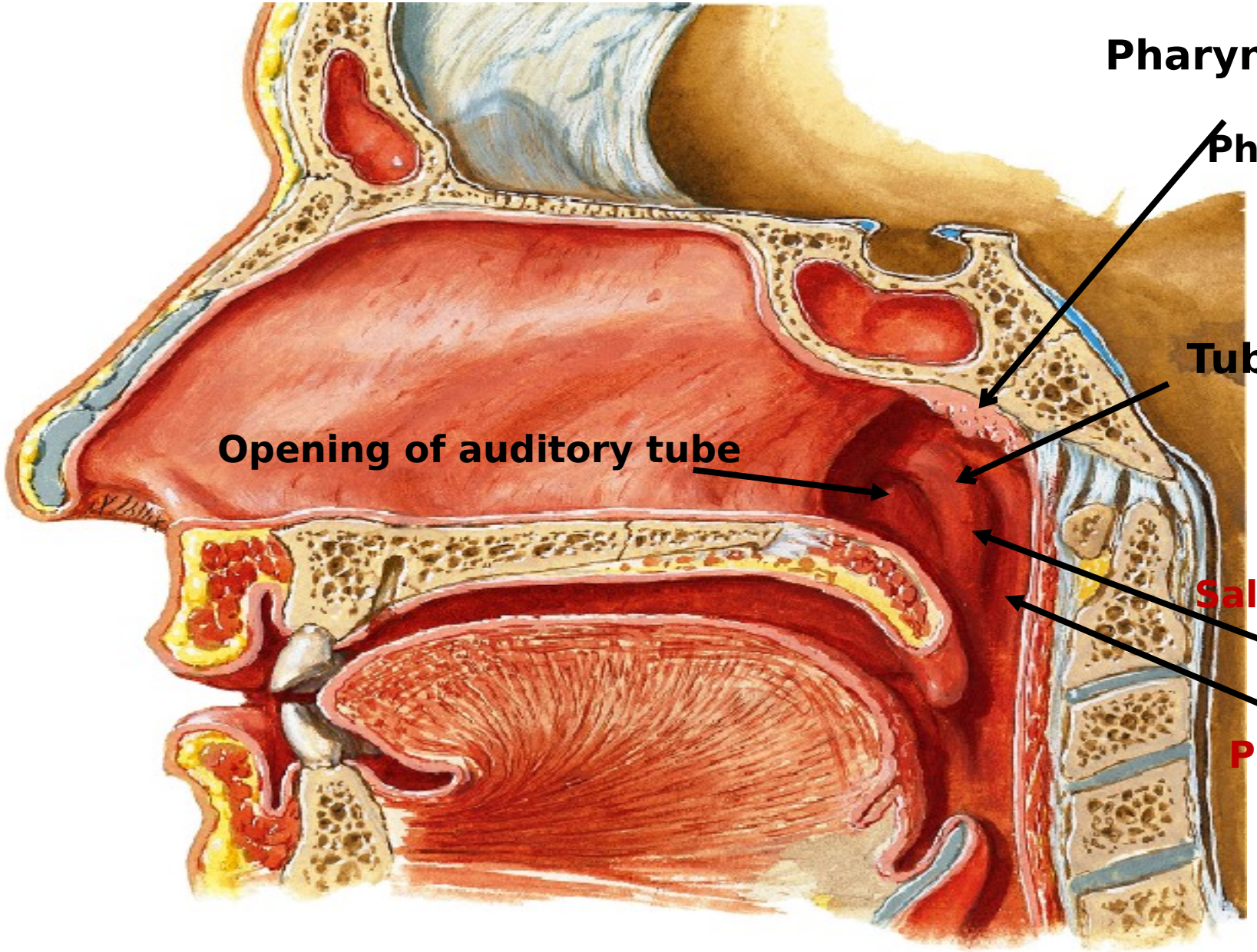
Tubal elevation: formed by posterior margin of auditory tube

Salpingopharyngeal fold : extends from the tubal elevation containing salpingopharyngeal muscle

Pharyngeal recess: behind the tubal elevation it is related to internal carotid artery

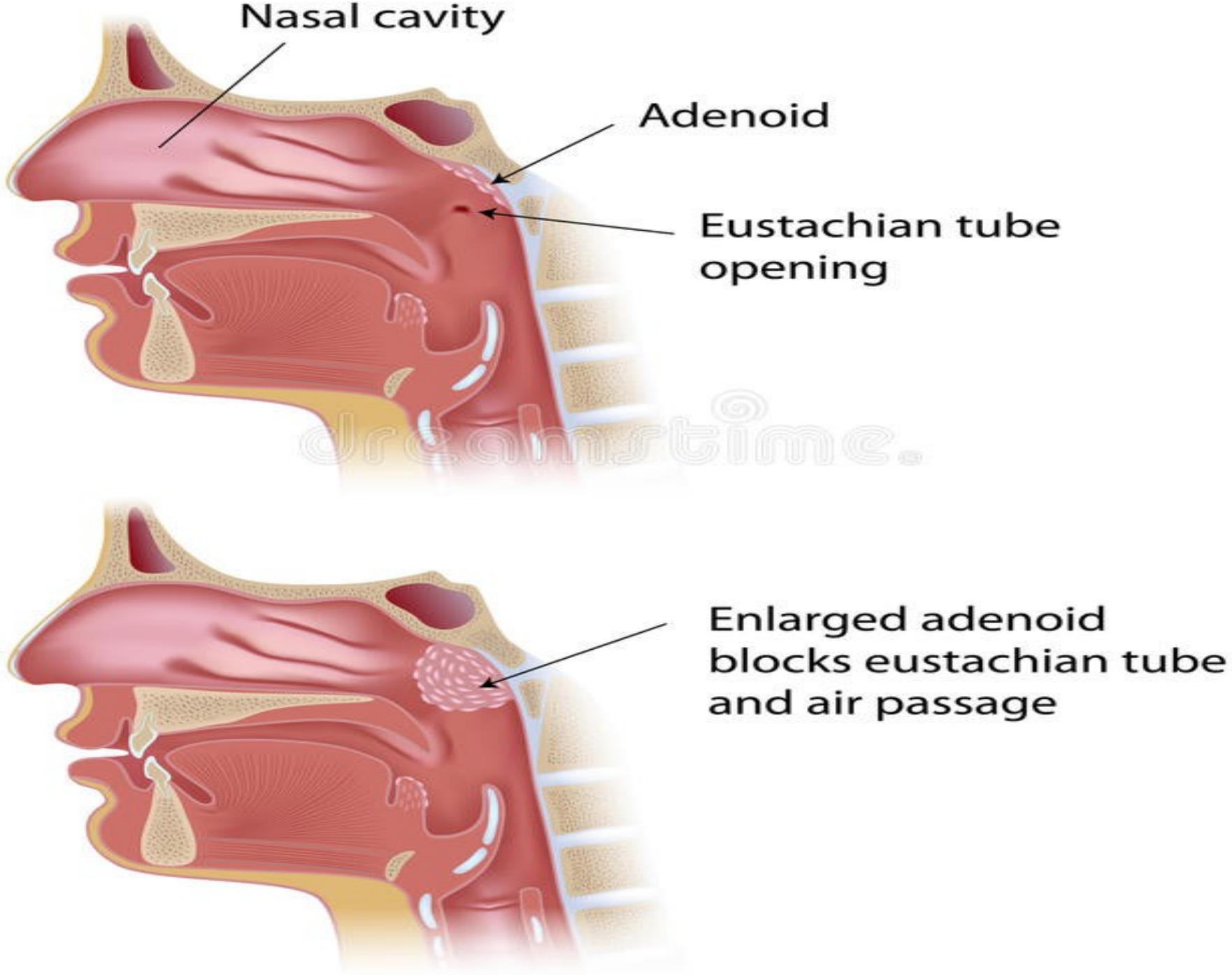
Tubal tonsil: lymphoid tissue around opening of auditory tube

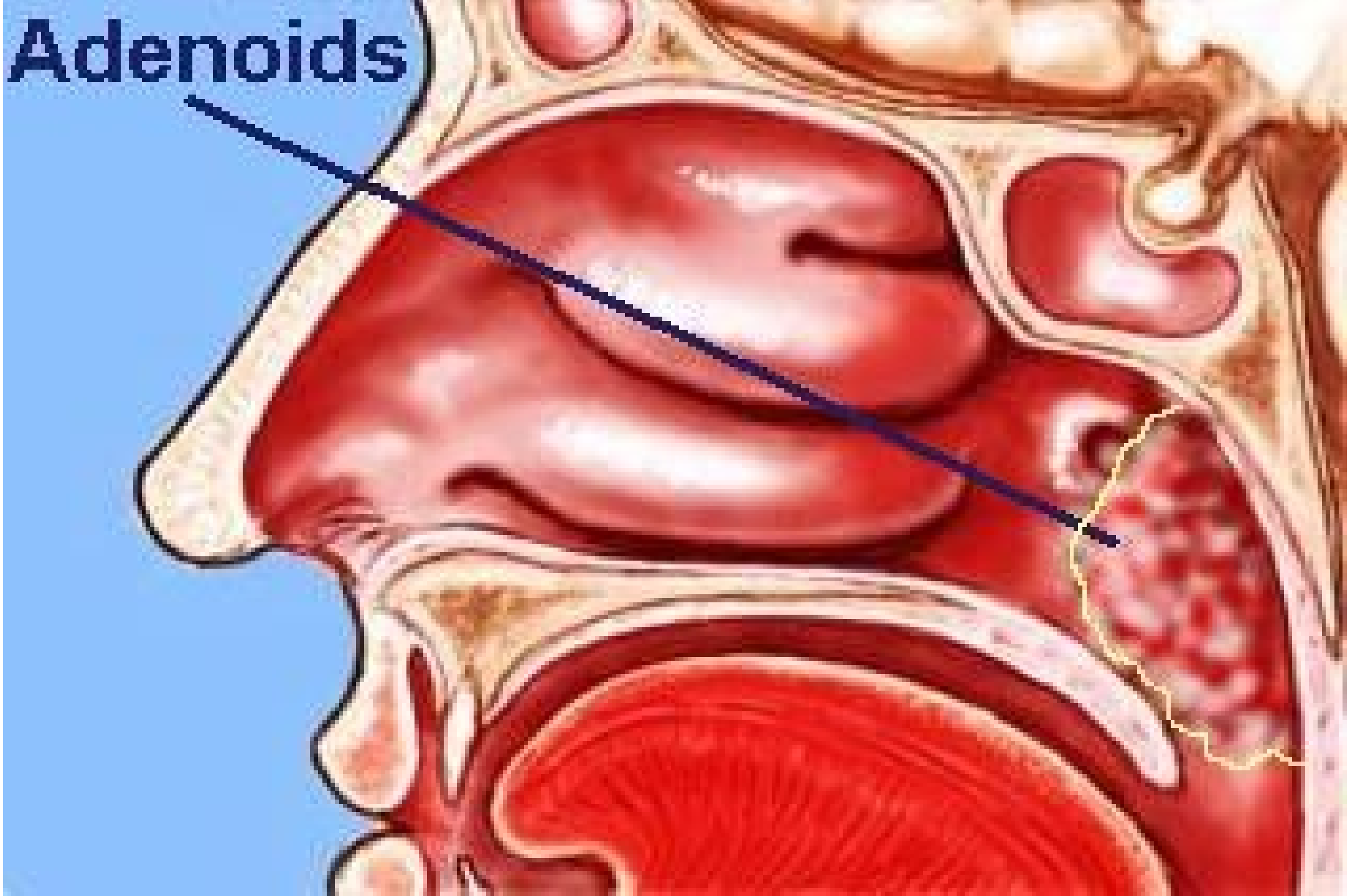



Pharyngeal tonsils
Pharyngeal tonsils
Tubal elevation
Opening of auditory tube
Salpingopharyngeal fo
Pharyngeal recess

Pharyngeal Tonsils - Adenoids

- Increase in size till age :6-7 years
- Then starts to atrophy
- If enlarged in children, it causes adenoids hypertrophy
- Obstructs air flow from nose to pharynx
- Child breathes through mouth

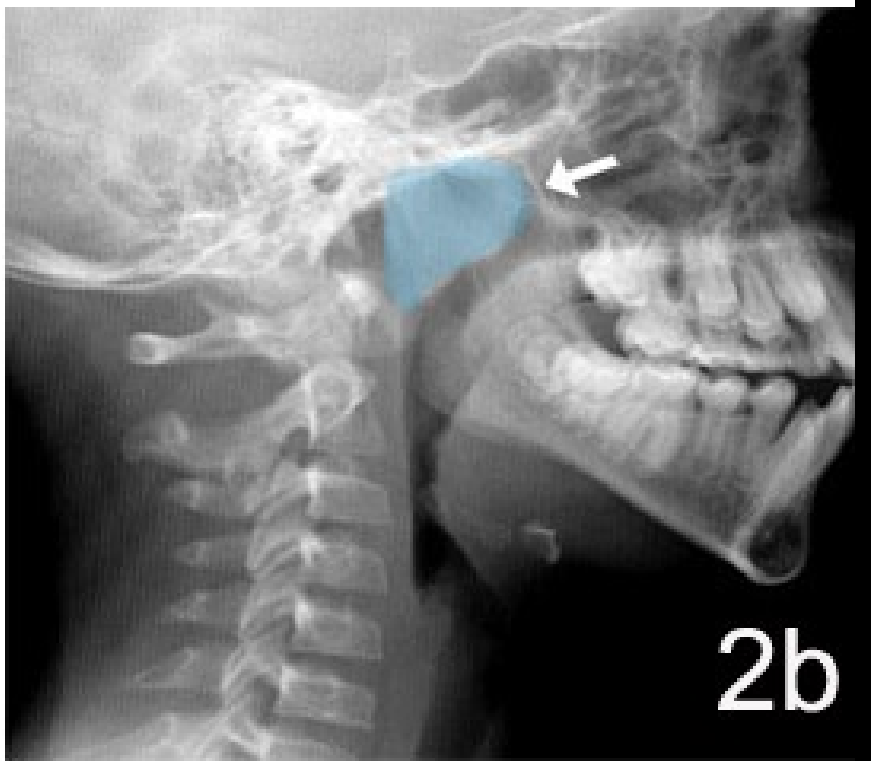

Nasal cavity
Adenoid
Eustachian tube opening
Enlarged adenoid blocks eustachian tube and air passage


Adenoids


1a


1b


2a


2b

Oropharynx

Location:

- Posterior to the oral cavity
- Inferior to the level of the soft palate.
- Superior to the upper margin of the epiglottis

Common respiratory and digestive pathway through which both air and swallowed food and drink pass.

Two pairs of tonsils, the ***palatine tonsils*** (in lateral wall) and ***lingual tonsils*** (in anterior wall) are found in the oropharynx.

Oropharynx - Boundaries

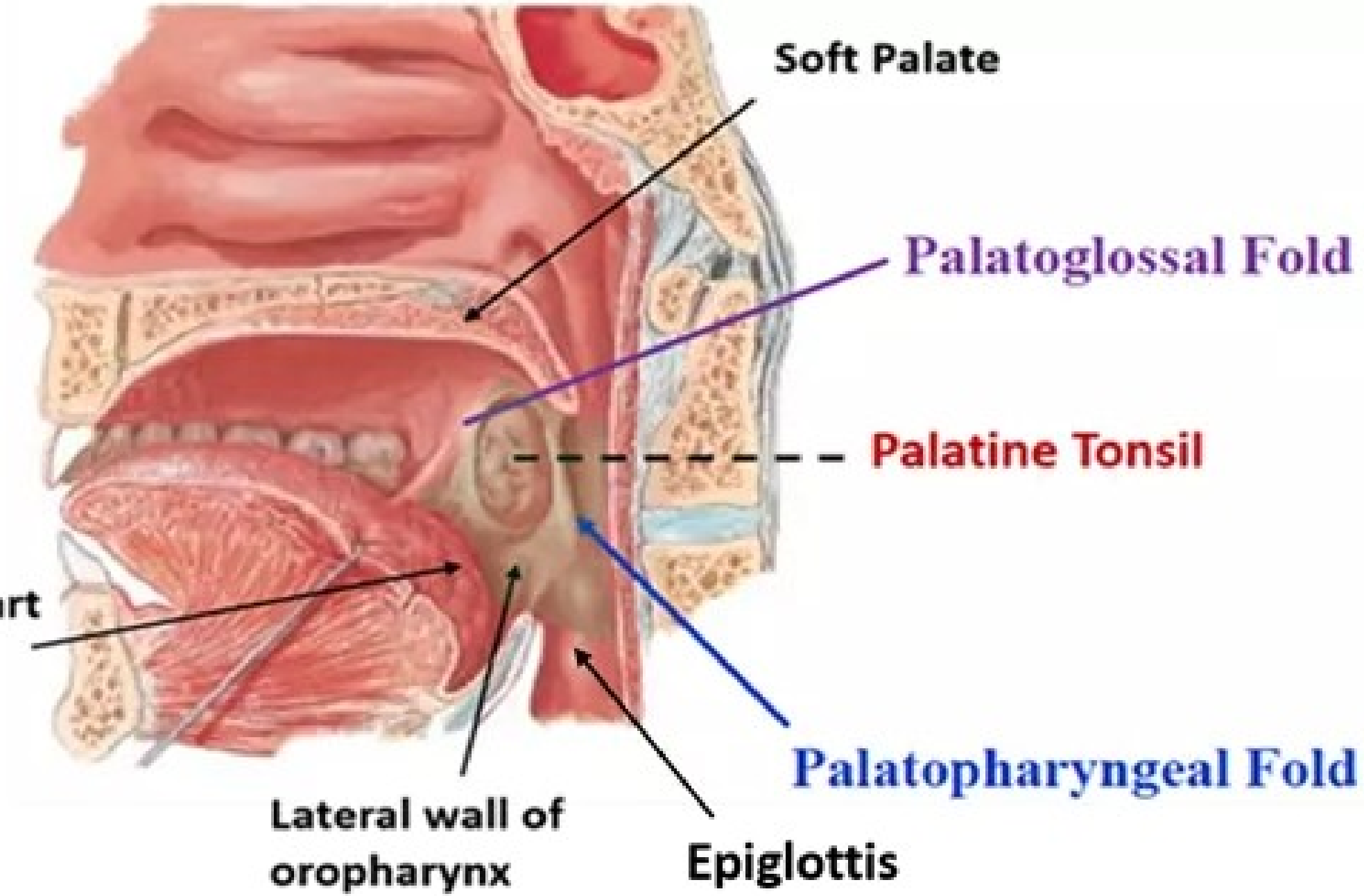
Roof: soft palate

Floor: posterior part of tongue

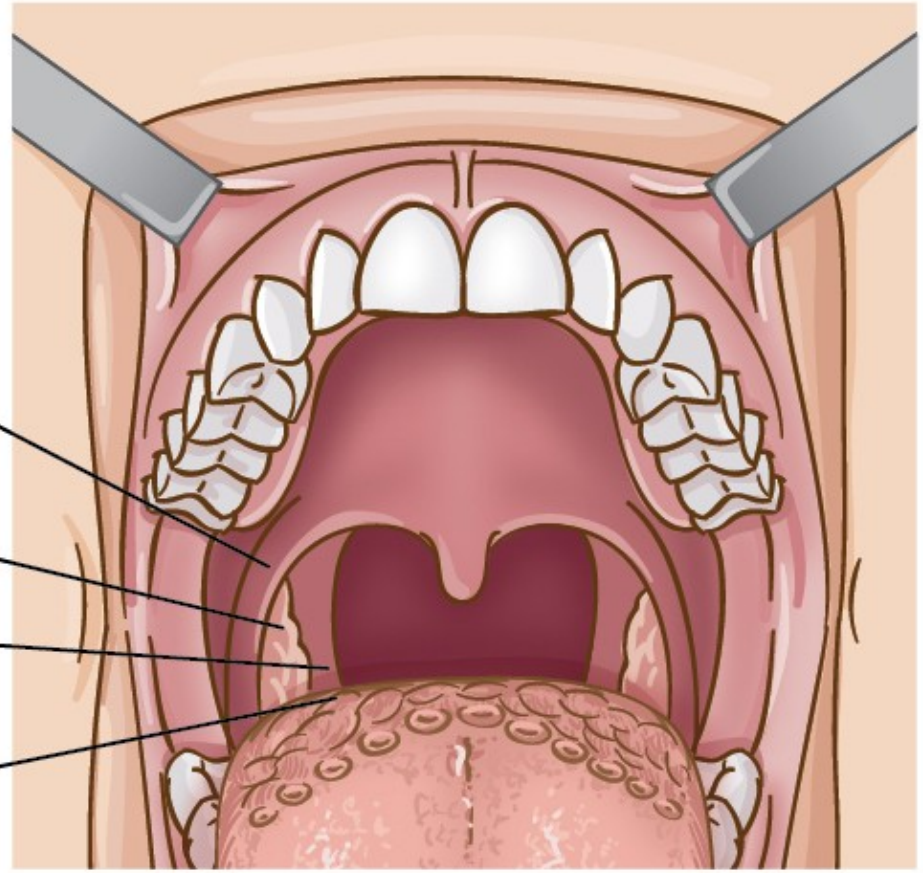
Anterior wall: absent it communicates with oral cavity via **oropharyngeal isthmus**

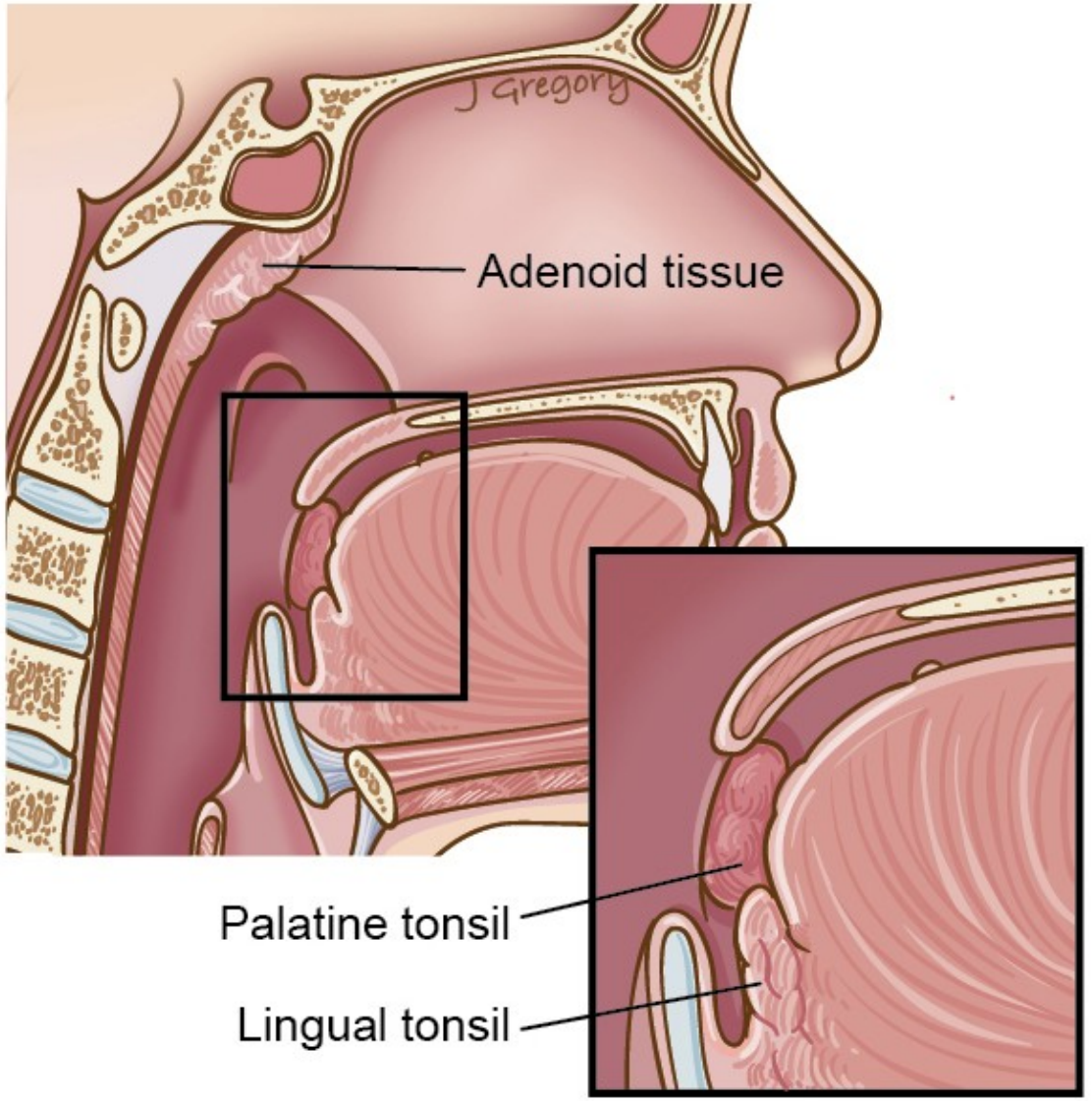
Posterior wall: C2-3

Lateral wall: it shows palatoglossal and palatopharyngeal arches with palatine tonsils in between


Soft Palate
Palatoglossal Fold
Palatine Tonsil
Posterior part of tongue
Palatopharyngeal Fold
Lateral wall of oropharynx
Epiglottis

Oropharynx


Anterior tonsillar pillar
Palatine tonsil
Posterior tonsillar pillar
Lingual tonsils


J Gregory
Adenoid tissue
Palatine tonsil
Lingual tonsil

Palatine Tonsils

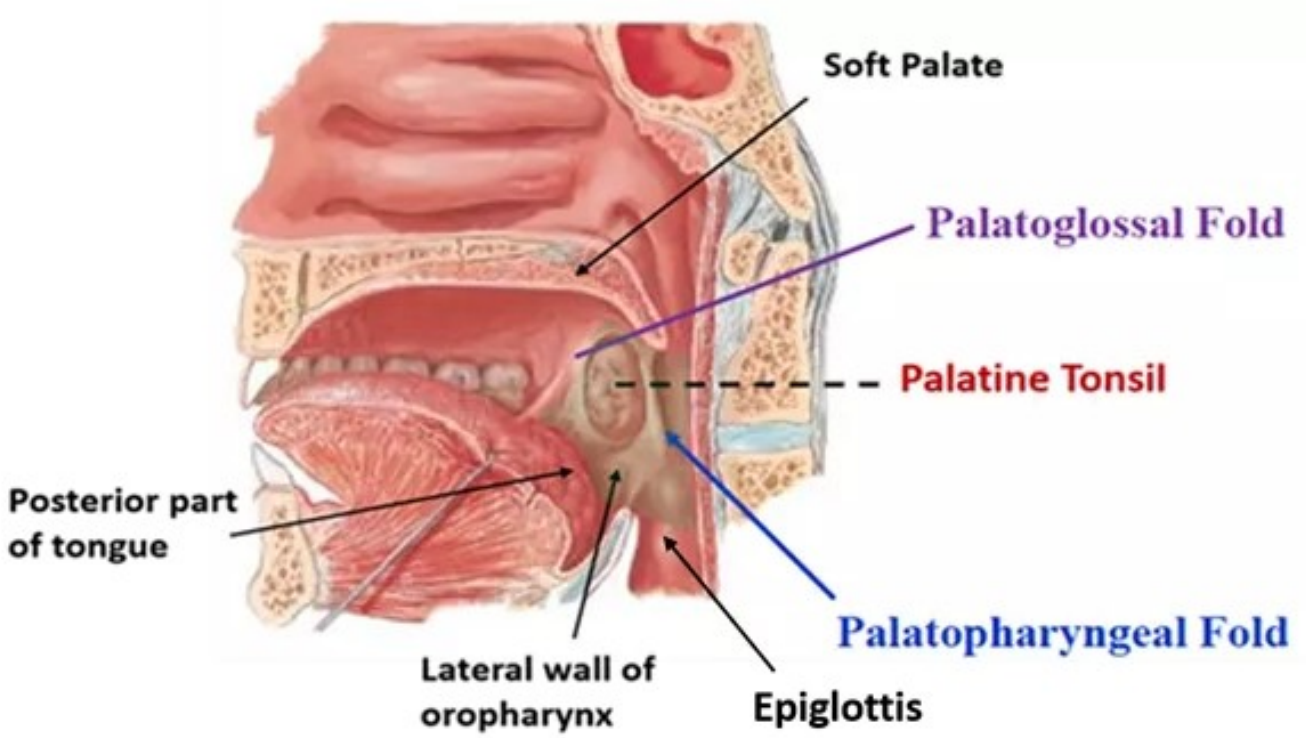
Lymphoid tissue in lateral wall of oropharynx oval in shape.

Anterior border : related to palatoglossal arch

Posterior border: related to palatopharyngeal arch

Lateral surface: has capsule& resting on tonsillar bed

Medial surface : free surface which shows tonsillar crypts



Tonsillar Bed

Tonsillar bed:

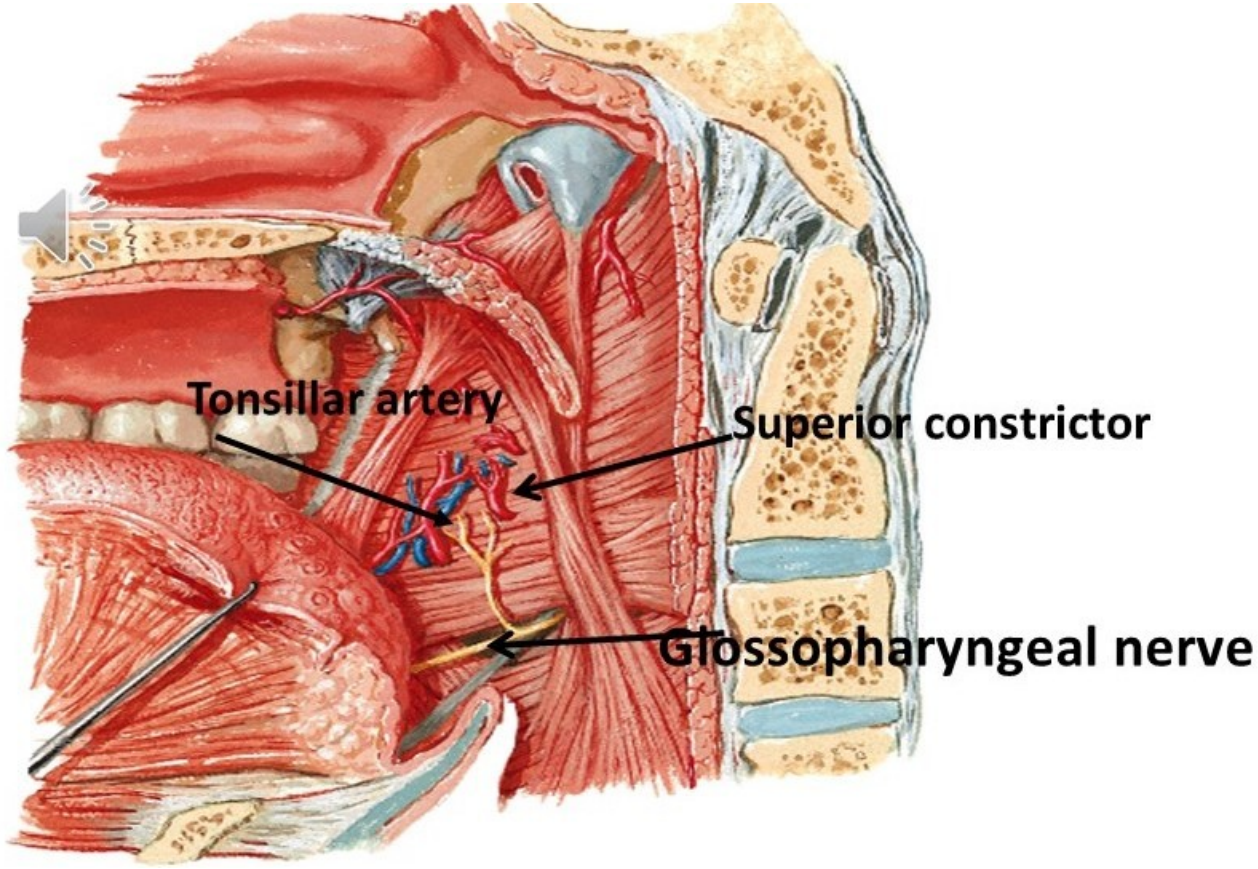
Superior constrictor muscle

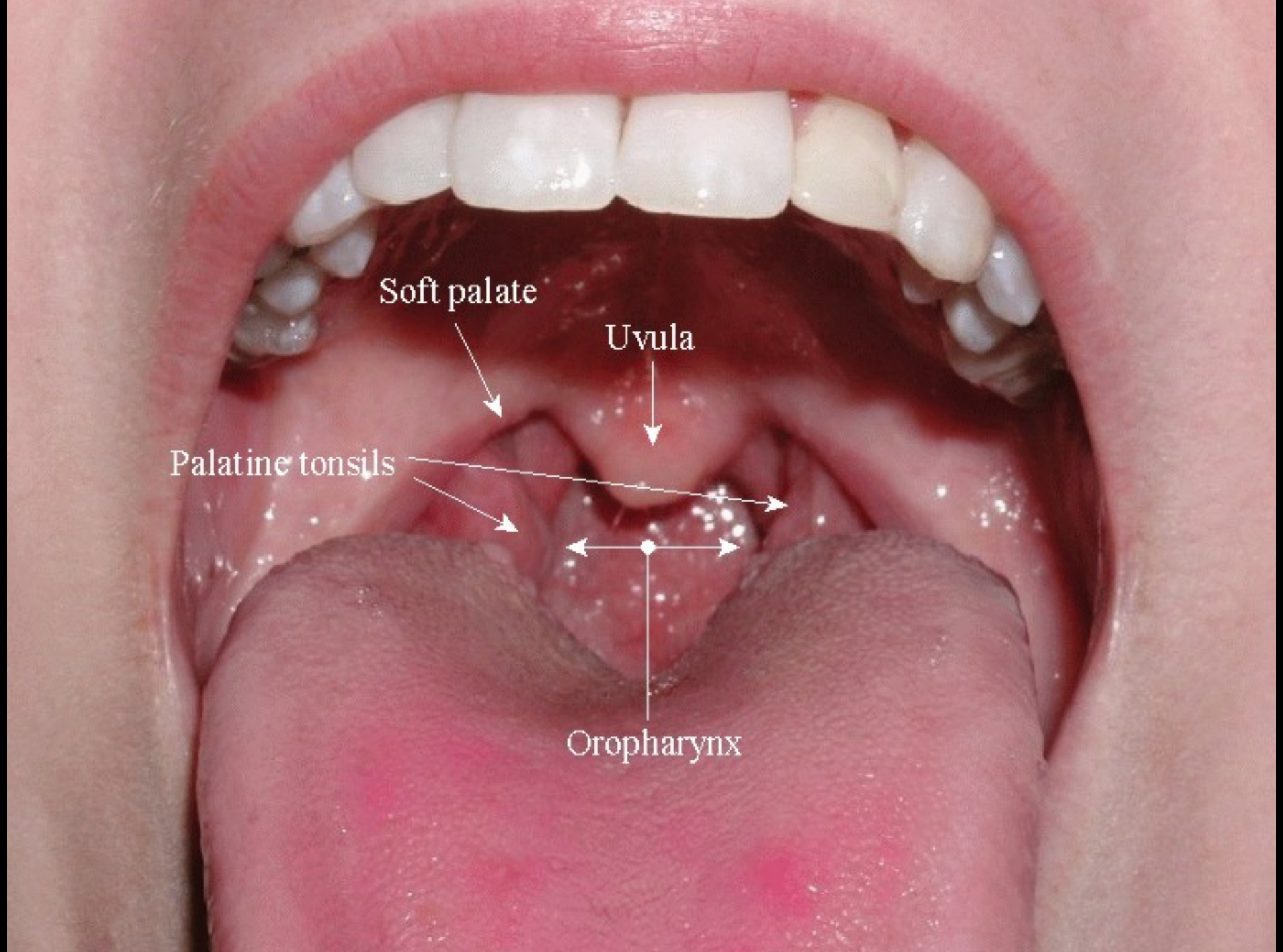
Styloglossus

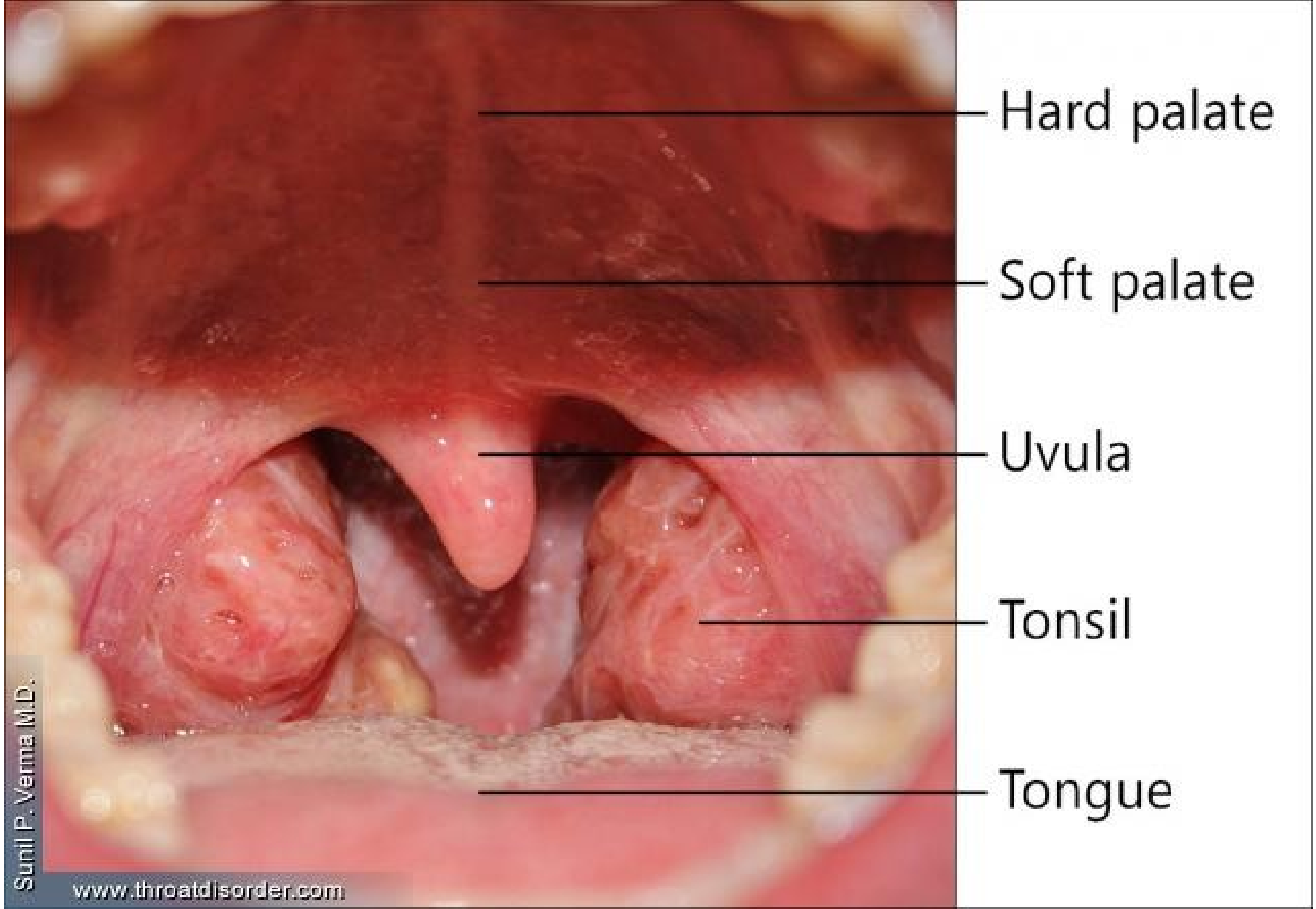
Tonsillar artery & ascending palatine branches of facial artery

Supplied by Glossopharyngeal nerve

Para-tonsillar veins causes bleeding after tonsillectomy




Soft palate
Uvula
Palatine tonsils
Oropharynx


Hard palate
Soft palate
Uvula
Tonsil
Tongue
Sunil P. Verma M.D.
www.throatdisorder.com

Oropharynx

Blood supply

Tonsillar artery, from facial main supply
Dorsal Lingual artery
Greater palatine
Ascending palatine
Ascending pharyngeal

Venous drainage : Para-tonsillar vein& pharyngeal vein & facial vein

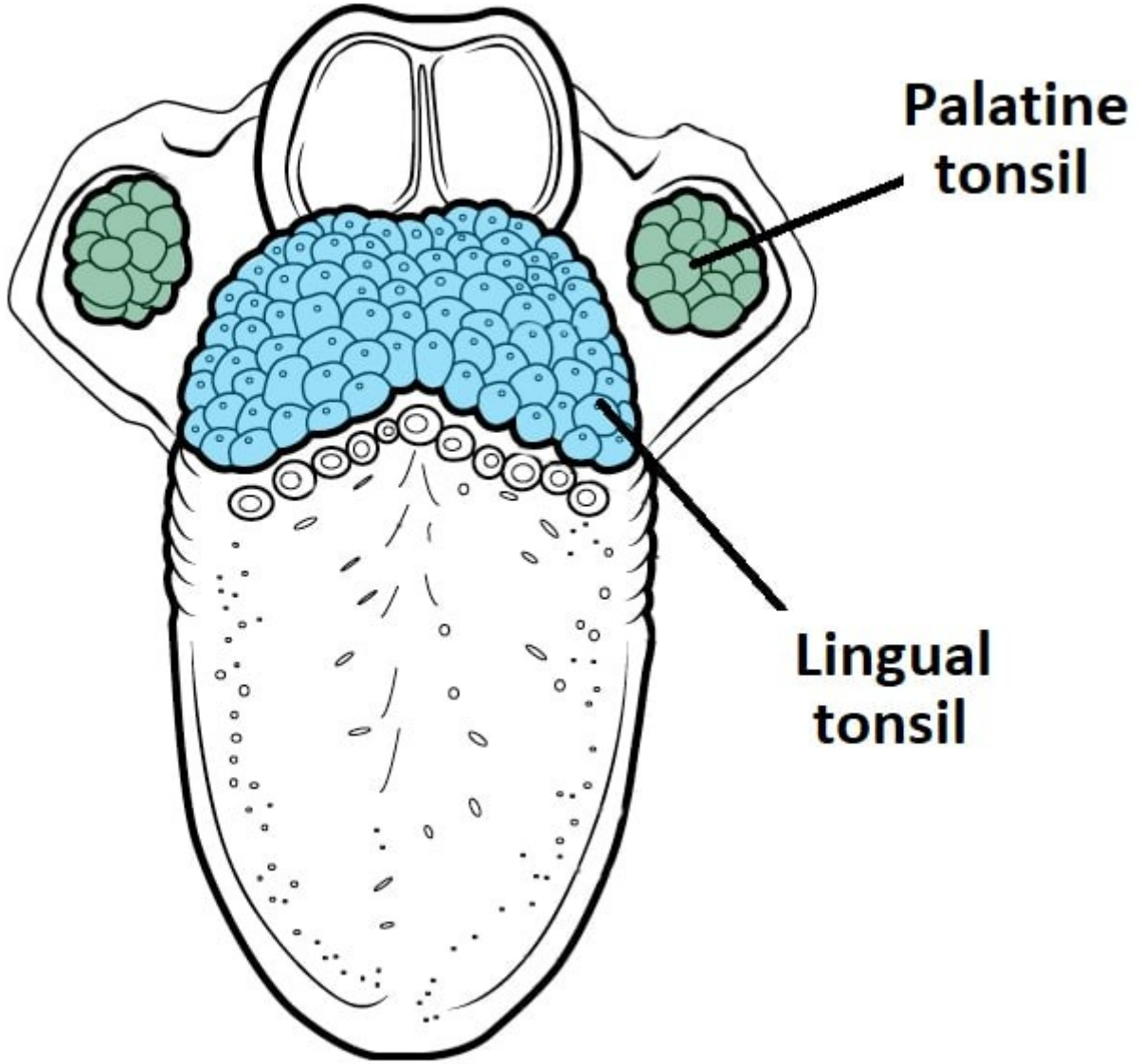
Lymph drainage: jugulodigastric LN

Nerve supply : tonsillar branch of glossopharyngeal

Oropharynx

Lingual tonsils

The anterior wall of the oropharynx inferior to the oropharyngeal isthmus is formed by the upper part of the posterior one-third of the tongue. The **lingual tonsil** is in the mucosa covering this part of the tongue

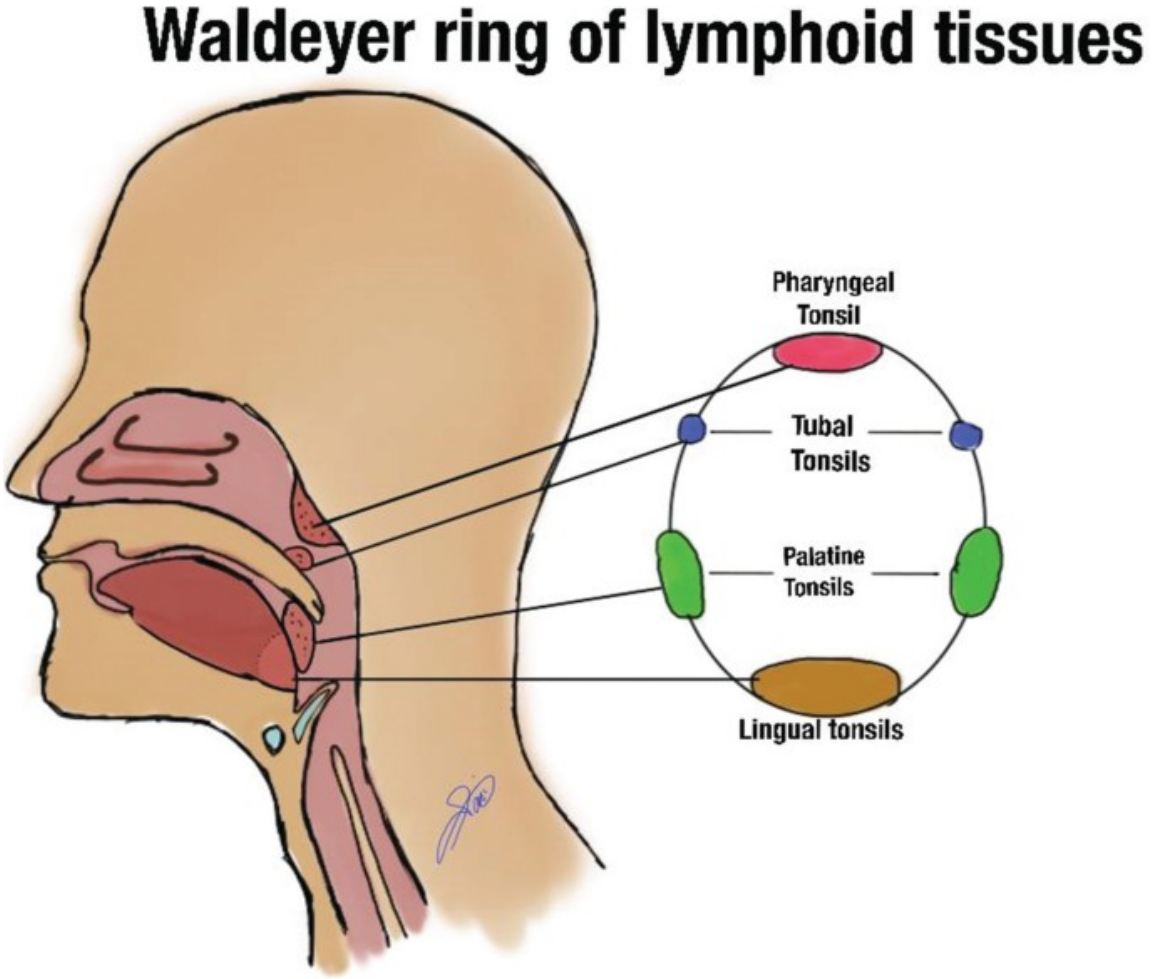


Oropharynx

A ring that encircles the entry of digestive system & respiratory system

It is formed of

1. ***Pharyngeal tonsils superior***
2. ***Tubal tonsils***
3. ***Palatine tonsils lateral***
4. ***Lingual tonsils inferior***



For Defense mechanisms

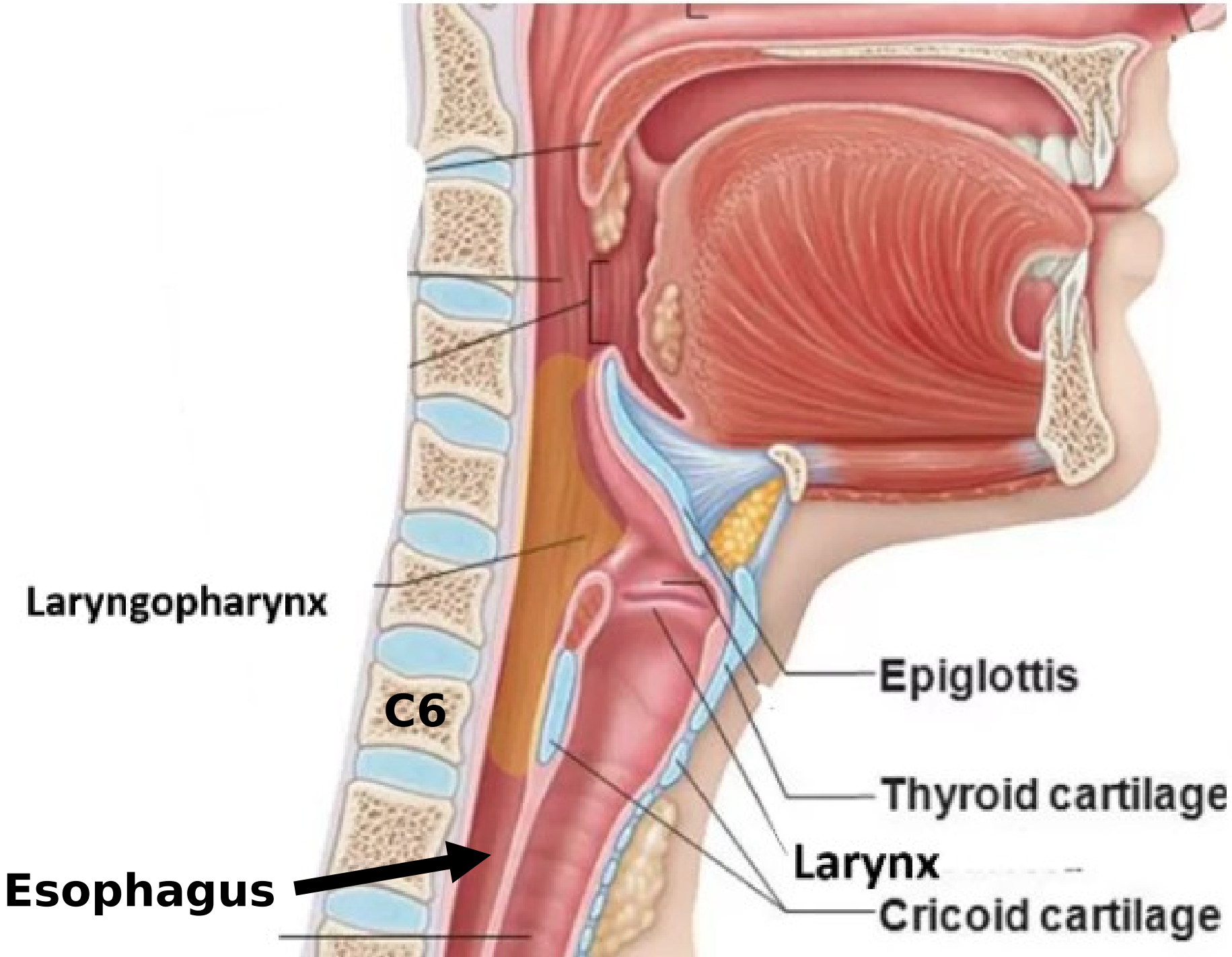
Laryngopharynx (Hypopharynx)

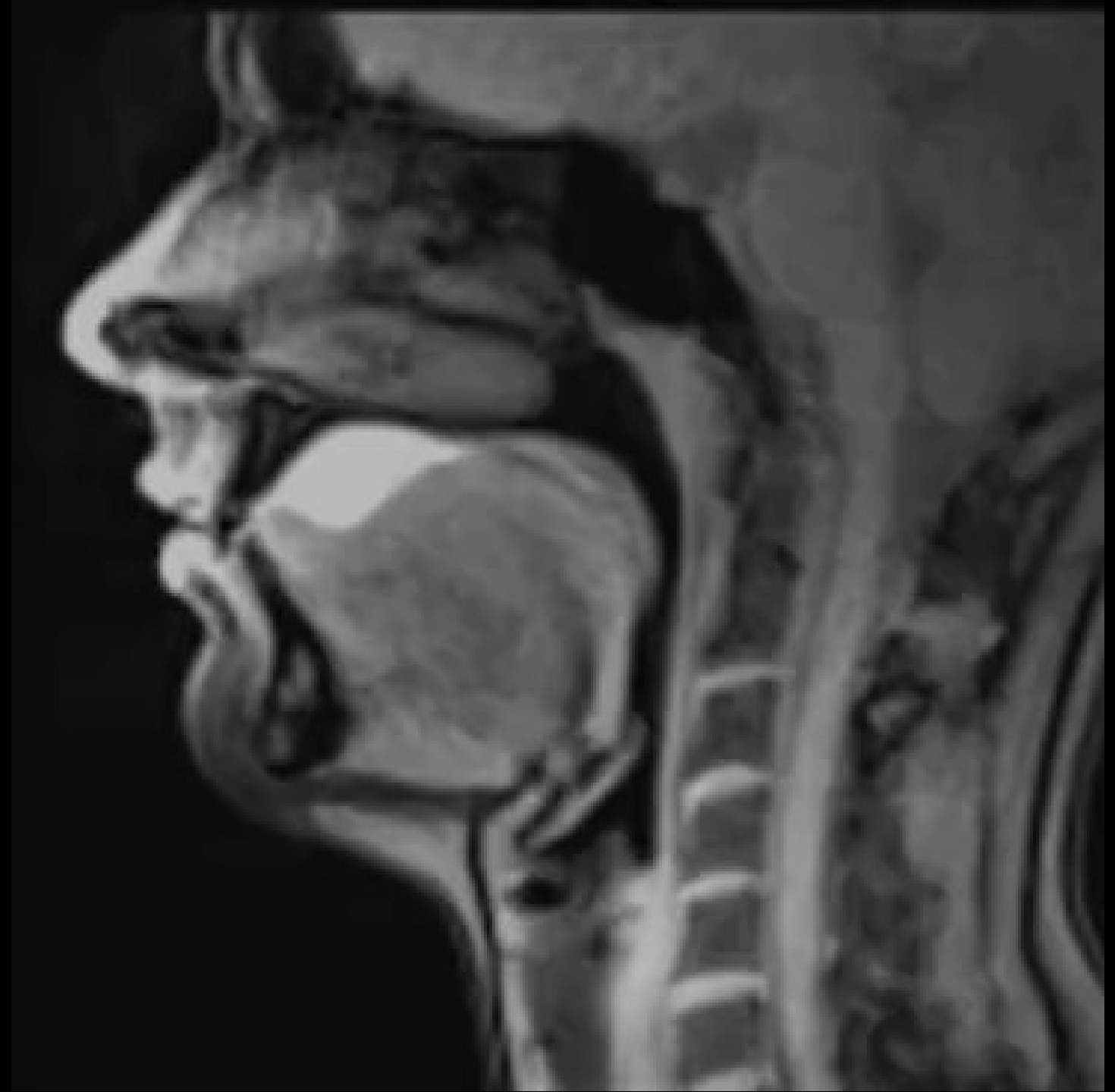
The laryngopharynx is the most inferior part of the pharynx. It communicates with the oropharynx above, the esophagus below and the larynx (***through the laryngeal inlet) anteriorly***.

The division of the oropharynx from the laryngopharynx is the tip of the ***epiglottis***. The esophagus begins at the level of the inferior border of the ***cricoid cartilage (C6).***

The spaces on either side of the larynx are the ***piriform fossae***, bounded ***medially*** by the ***aryepiglottic fold*** and ***laterally*** by the ***thyroid cartilage covered by thyrohyoid membran***. The branches of the internal laryngeal nerve (***from superior laryngeal nerve***) pass beneath the mucous membrane at this point.

Piriform fossa is commonly a site of foreign body impaction


Laryngopharynx
C6
Esophagus
Epiglottis
Thyroid cartilage
Larynx
Cricoid cartilage

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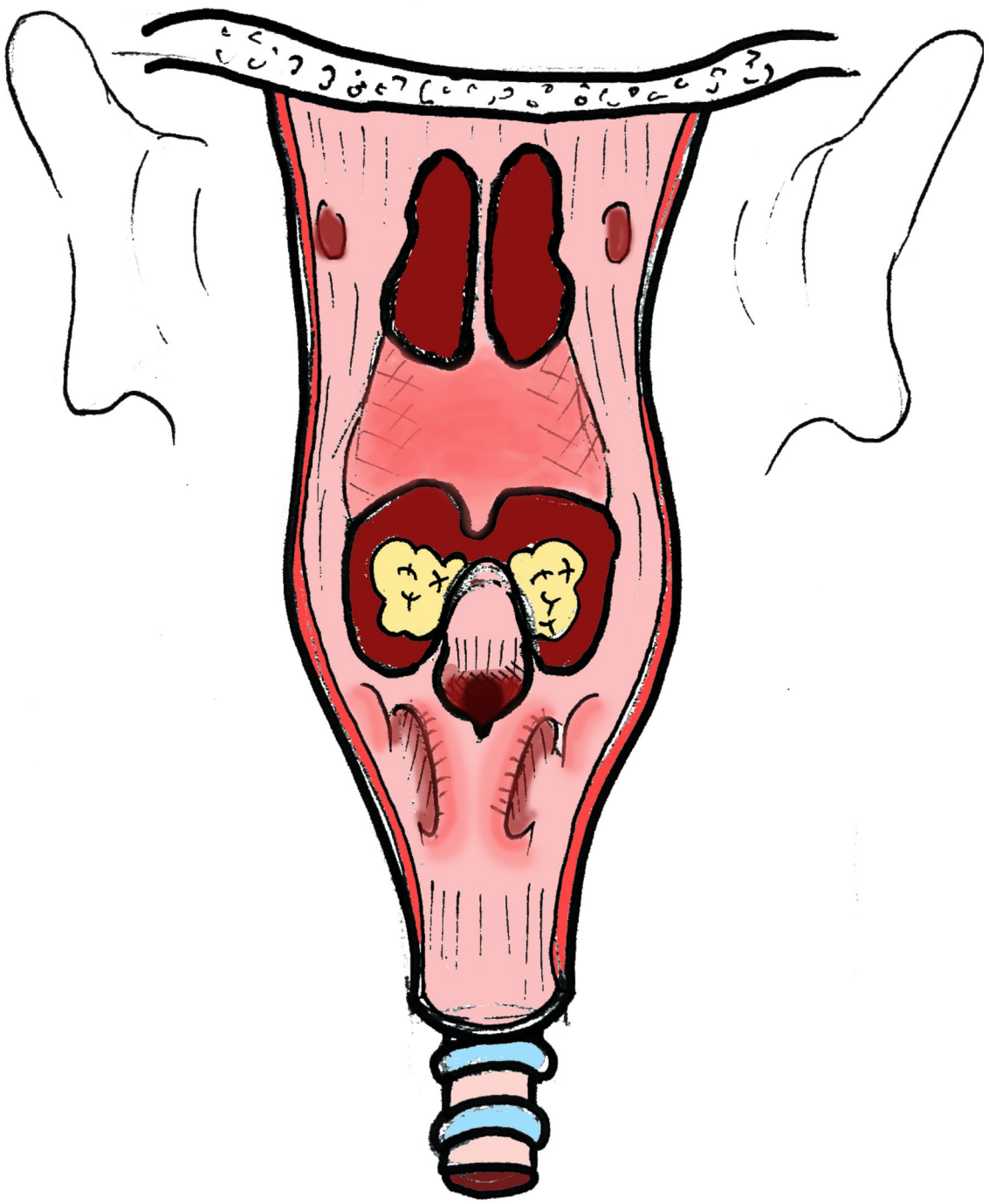
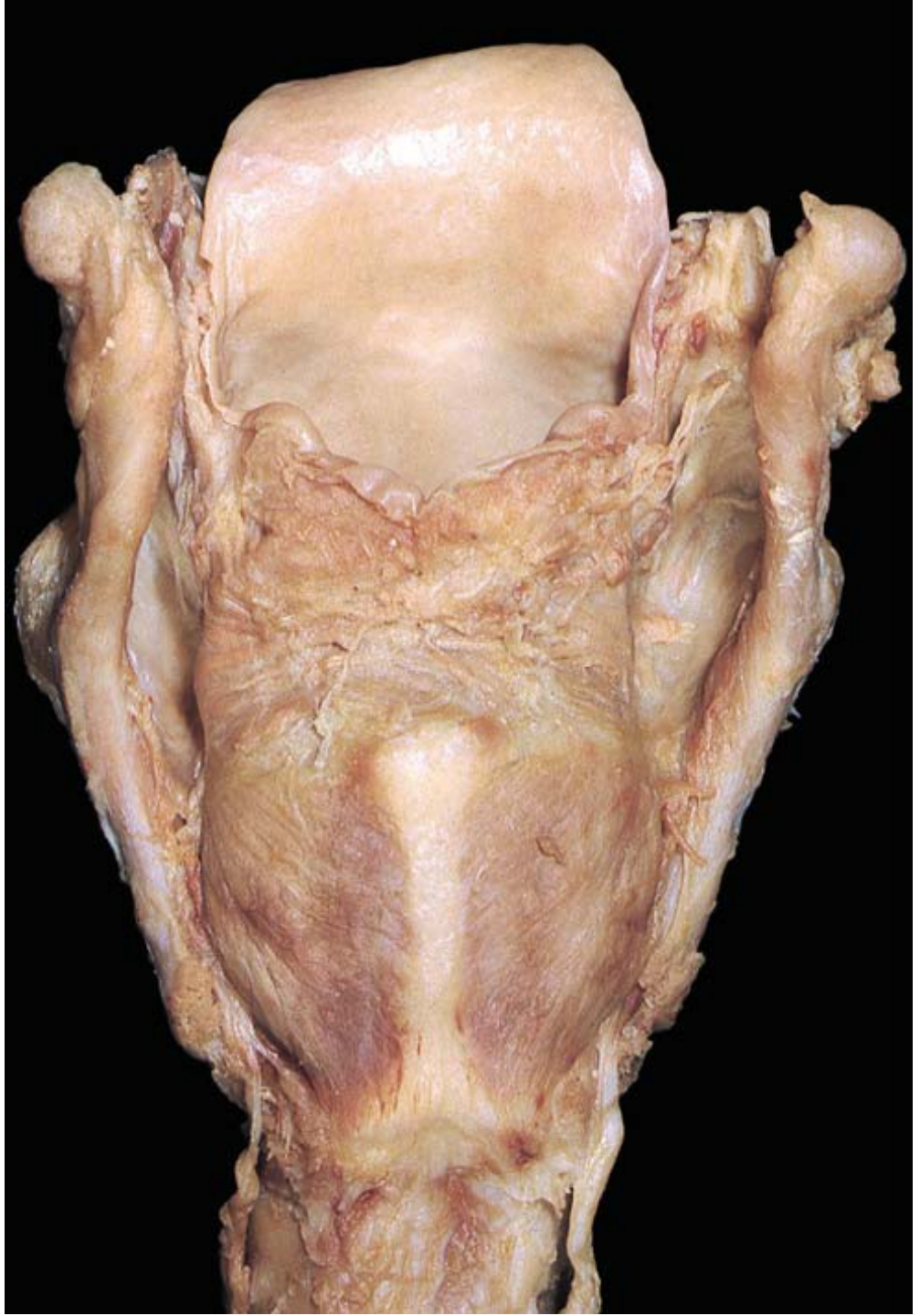
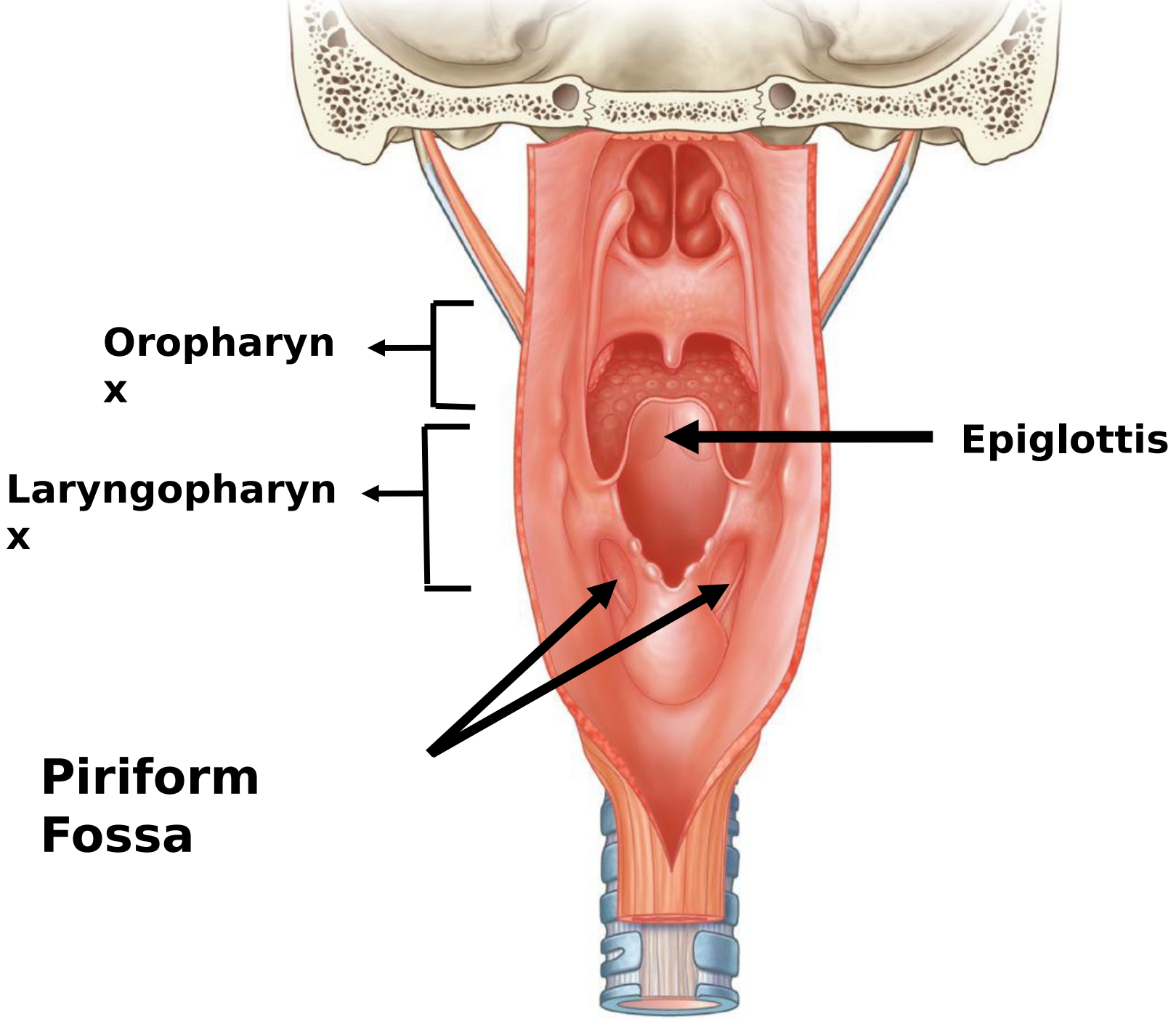
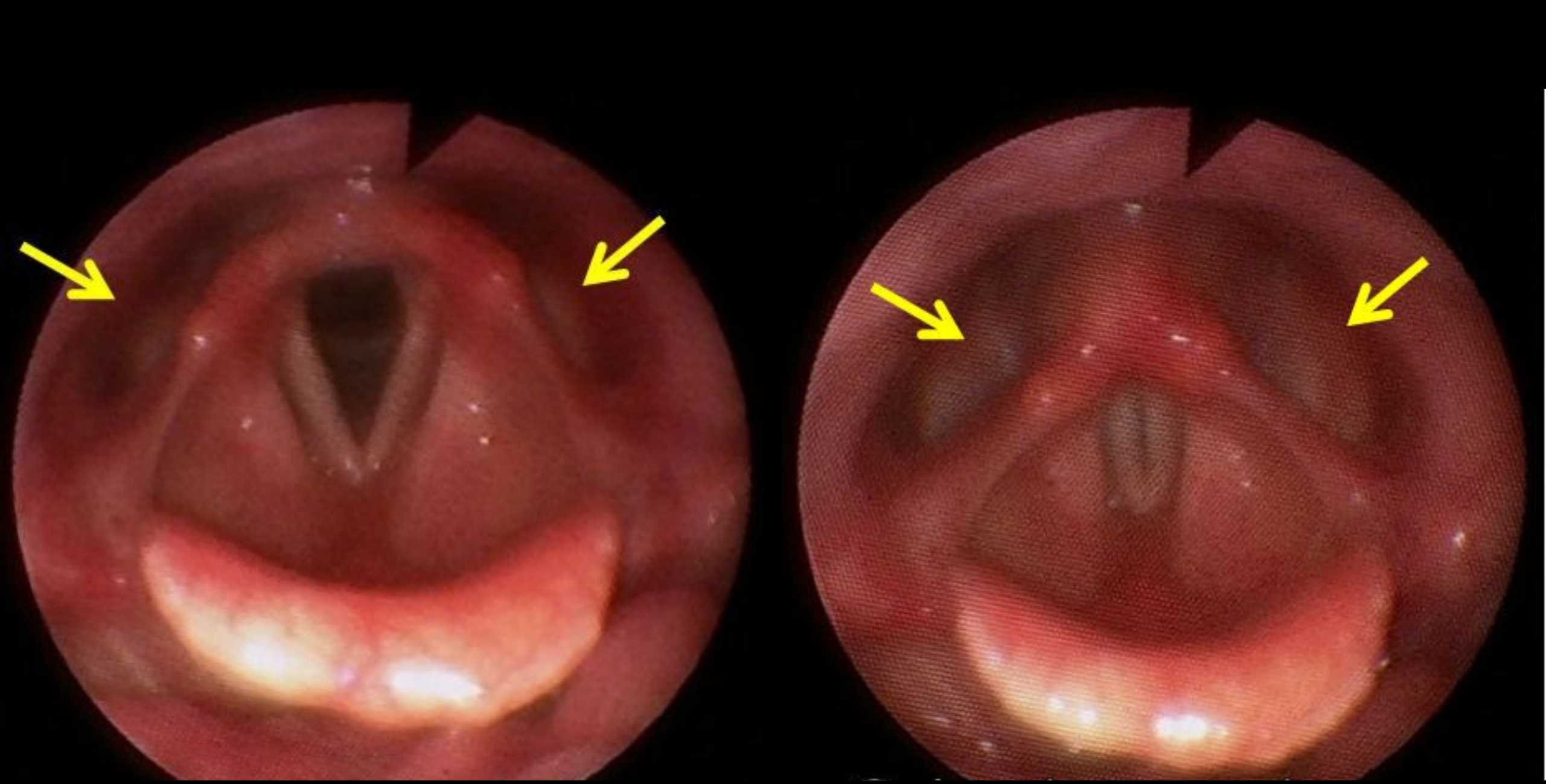




Ne


Oropharyn
x
Laryngopharyn
x
Epiglottis
Piriform
Fossa




Fish Bone in Lt Pyriform Fossa
AHLUWALIA HOSPITAL
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Muscles of pharynx

Constrictors

1. Superior constrictor
2. Middle constrictor
3. Inferior constrictor

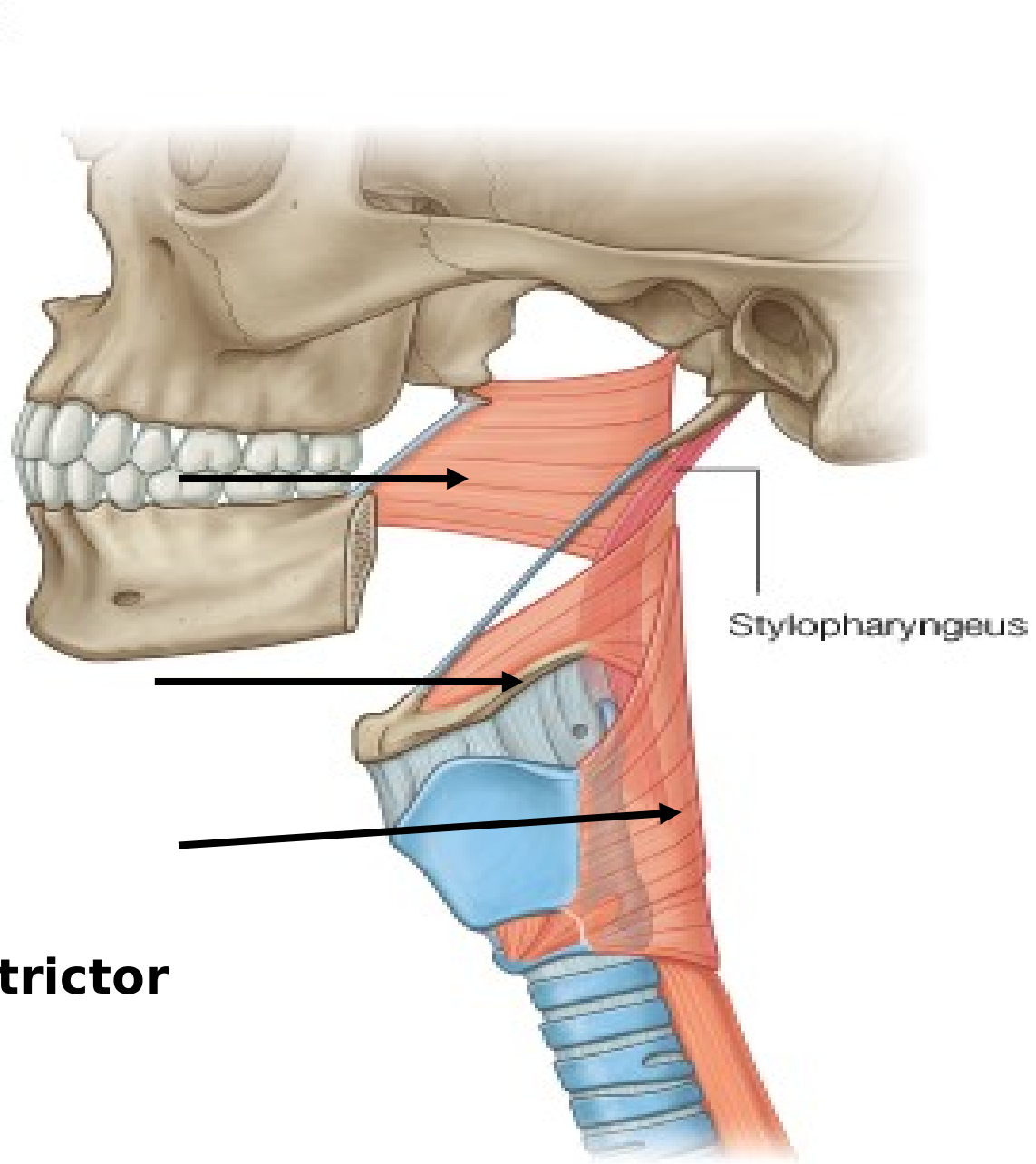
Longitudinal muscles

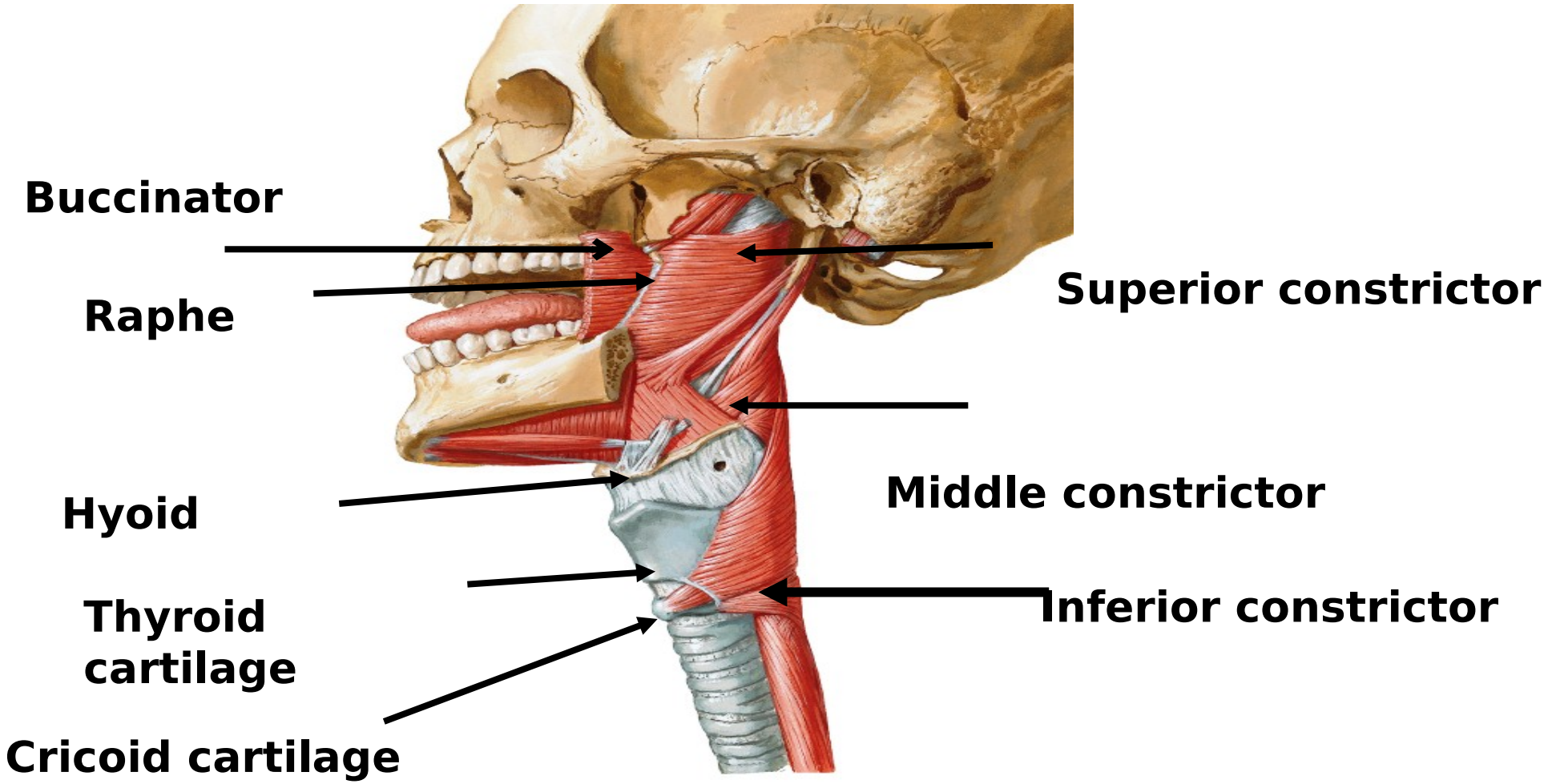
4. Stylopharyngeus
5. Platopharyngeus
6. salpingiopharyngeus

Superior constrictor

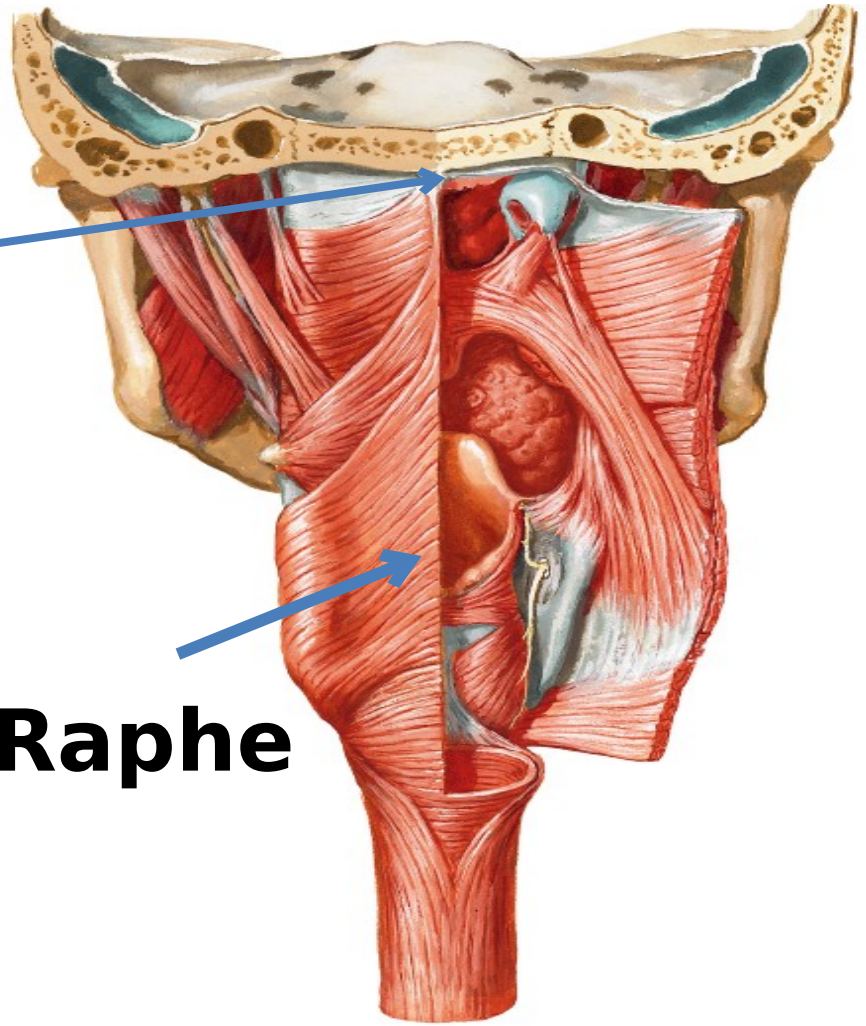
Middle constrictor

Inferior constrictor




Buccinator
Raphe
Superior constrictor
Middle constrictor
Hyoid
Thyroid cartilage
Inferior constrictor
Cricoid cartilage

haryngeal tubercle



Raphe

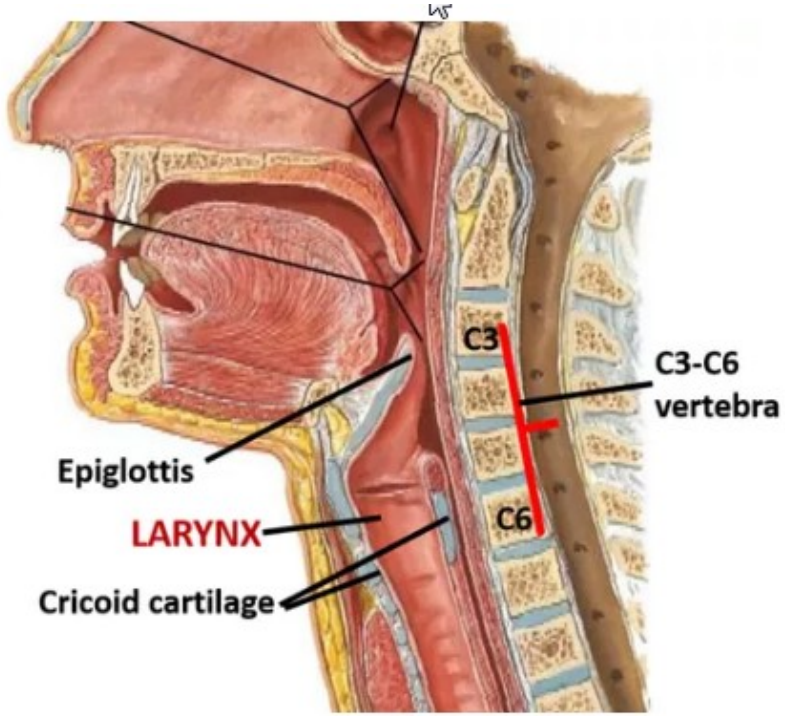
Larynx

Larynx is the organ of voice production (voice box).

Located in front of the neck **opposite to C3-C6 vertebrae**, **lying in front of laryngopharynx**.

Extends from the upper border of epiglottis to the lower border of cricoid cartilage.

At puberty, male larynx increases in size rapidly, and the angle of thyroid cartilage (**Adam's apple**) become prominent.



Extent
– C3 to C6 (adult)
– C1 to C4 (children)

Larynx

Relations:

Anteriorly:

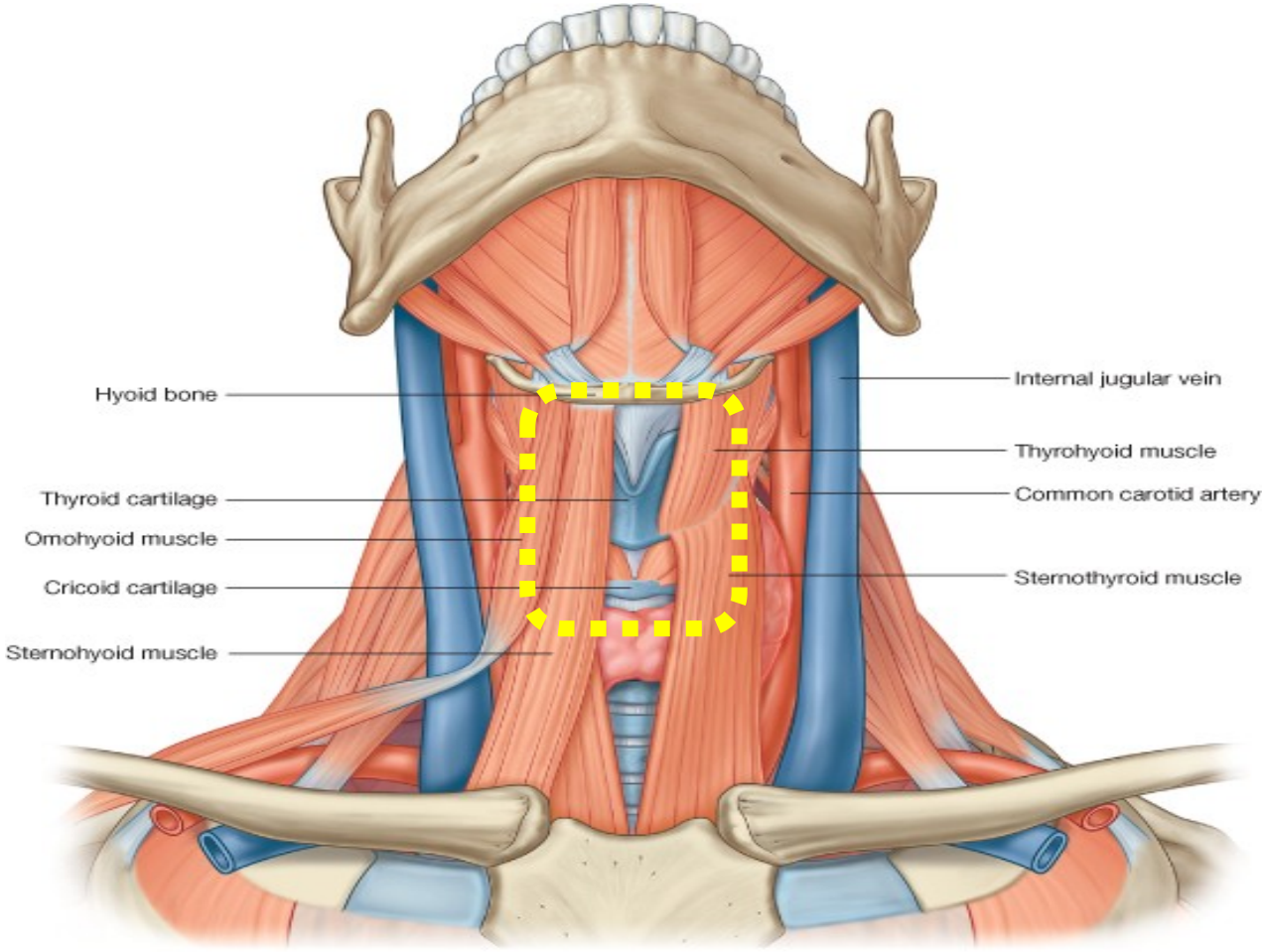
- Skin
- Superficial fascia
- Deep fascia
- Infrahyoid muscles.

Posteriorly:

- Laryngeopharynx
- Upper part of esophagus.

Laterally:

- Carotid sheath & thyroid gland



Larynx

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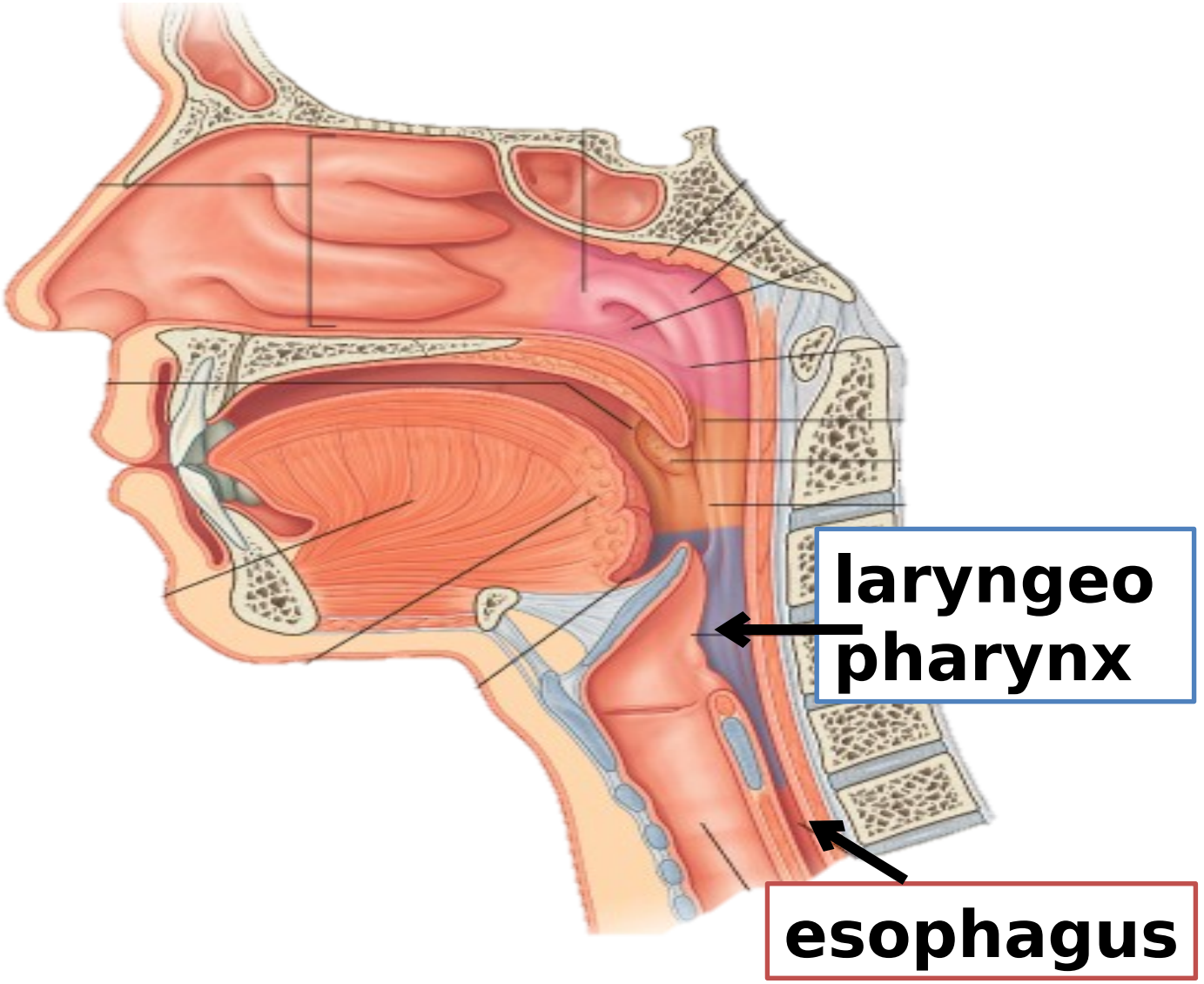
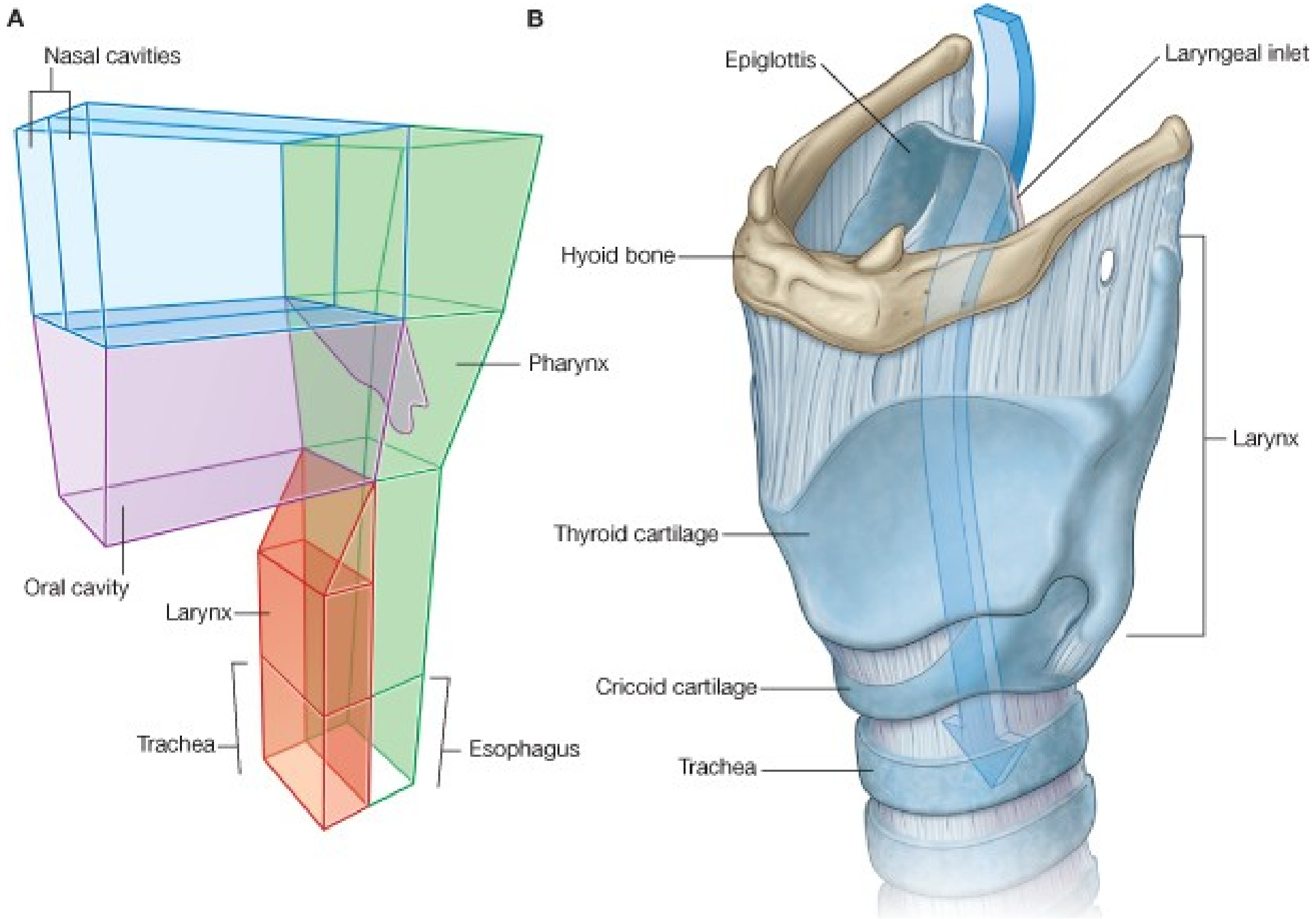


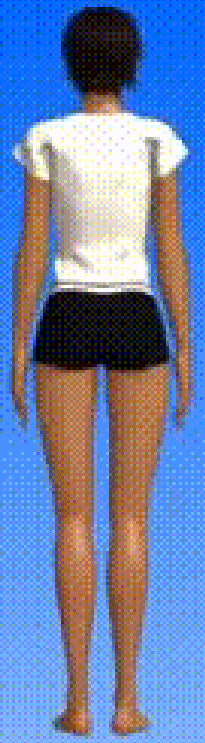
Larynx

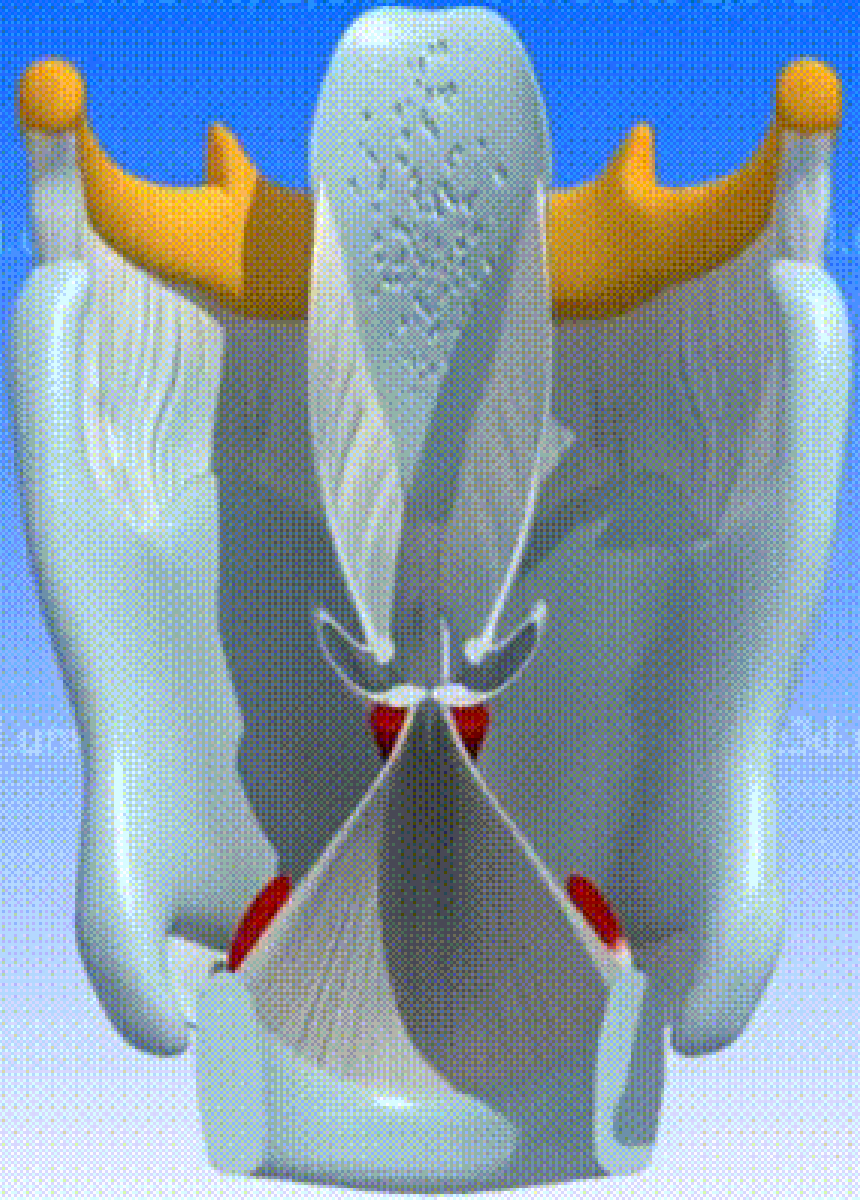
The larynx is the organ of:

1. Phonation (voice box)
2. Respiratory (air) passage
3. Acts as protective sphincter of lower respiratory tract

The larynx is suspended from the **hyoid bone** above and attached to the **trachea** below by membranes and ligaments.


A
Nasal cavities
Pharynx
Oral cavity
Larynx
Trachea
Esophagus
B
Epiglottis
Laryngeal inlet
Hyoid bone
Larynx
Thyroid cartilage
Cricoid cartilage
Trachea





The vocal folds are joined

The Framework of the Larynx

The framework of the larynx consists of **cartilages, ligaments** and **membranes**.

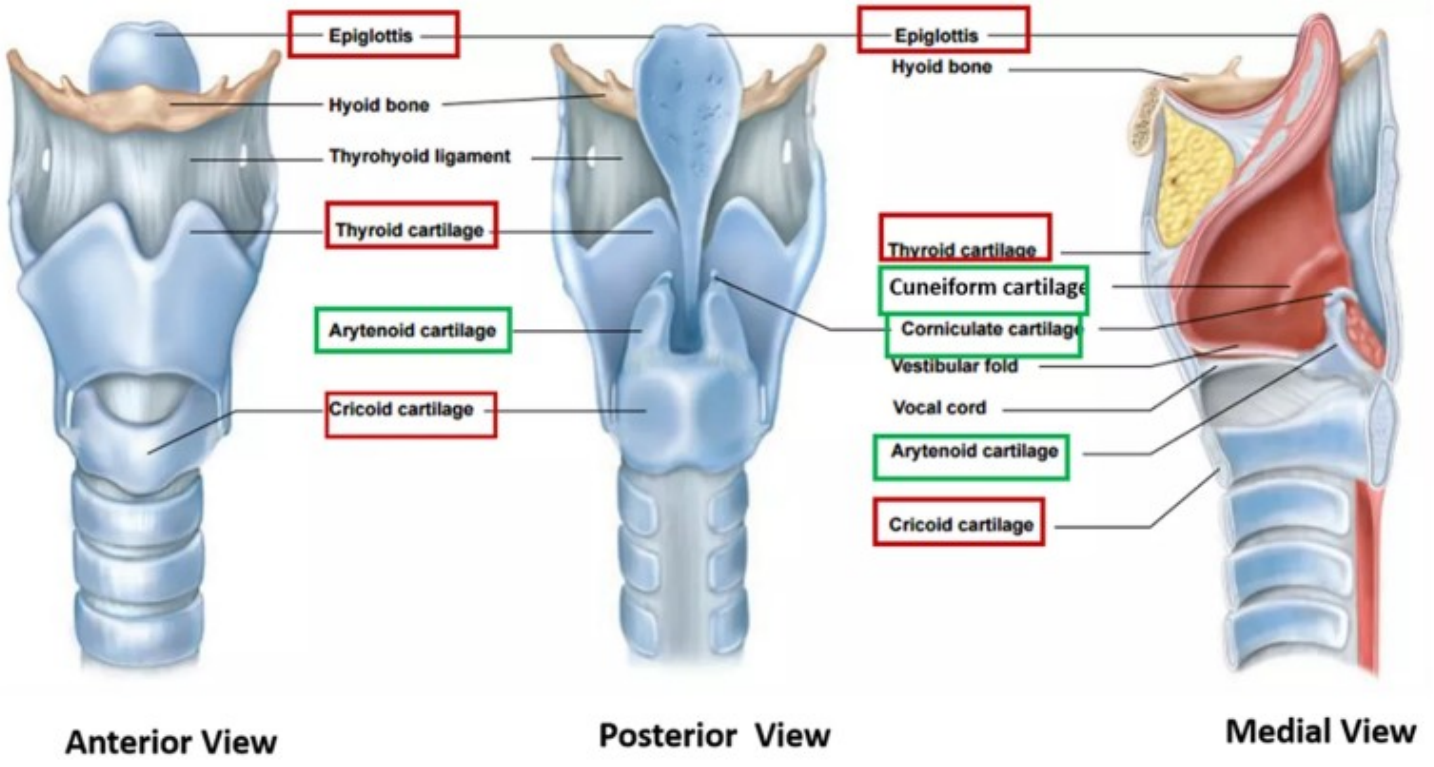
Cartilages are **3 unpaired** and **3 paired**:

- **Unpaired**

Thyroid cartilage
Cricoid cartilage
Epiglottis

- **Paired**

Arytenoid cartilage
Corniculate cartilage
Cuneiform cartilage



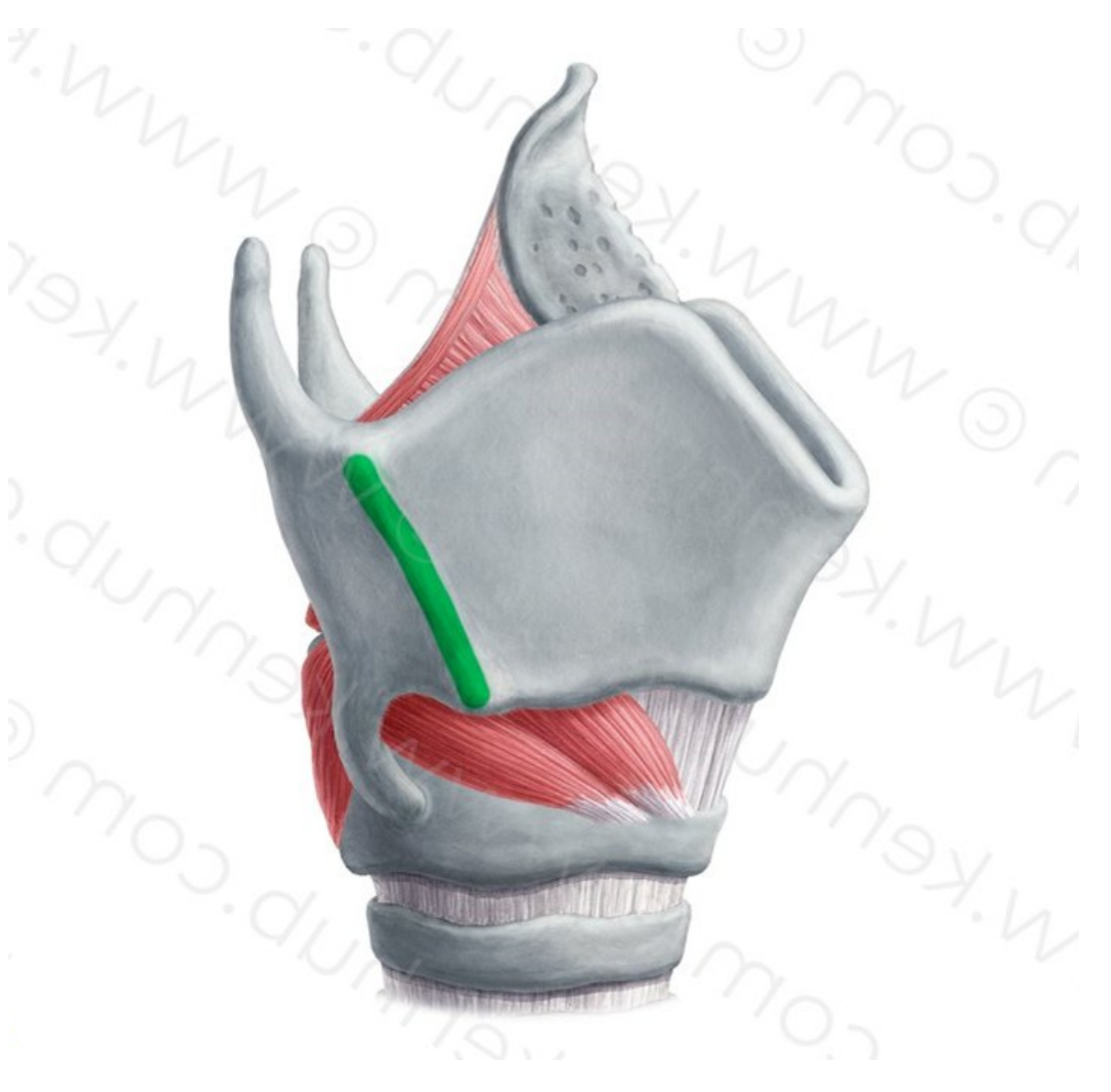
Cartilages of the Larynx

Thyroid Cartilage

It is the ***largest*** of the laryngeal cartilages

V-shaped hyaline cartilage with two laminae ***fused*** in the ***median*** plane that forms the ***laryngeal prominence*** (**'Adam's apple**').


manus tua omnibus inim icis tuis
Pones eos ut caldarium
ignis in tempore



Thyroid Cartilage

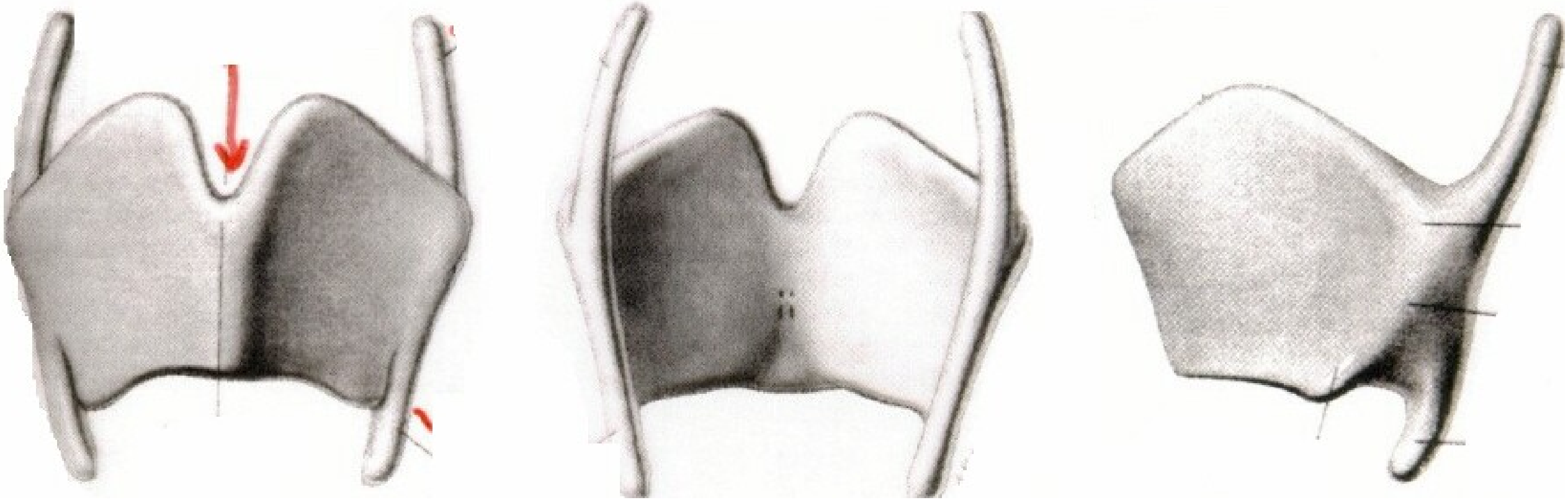
2 lamina united anterior

90 degree in males and 120 degrees in females

Separated posterior

Posterior border : shows superior & inferior horns

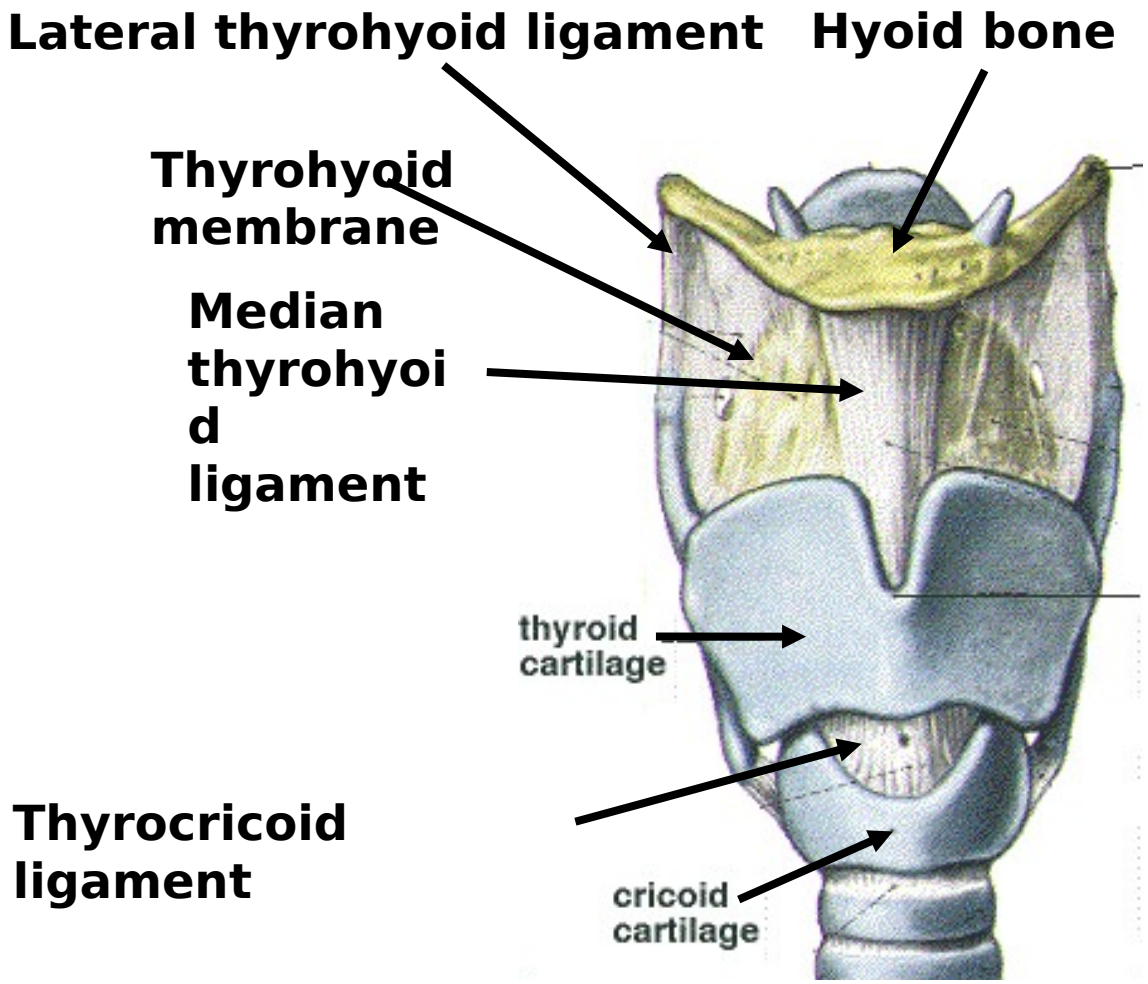
Oblique line: gives attachments to sternothyroid, thyrohyoid & inferior constictor



Cartilages of the Larynx

The upper border of thyroid cartilage provides attachment for the ***thyrohyoid membrane*** and ***thyrohyoid ligaments***.

The lower border of thyroid cartilage provides attachment for the ***cricothyroid ligament***.


Lateral thyrohyoid ligament
Hyoid bone
Thyrohyoid membrane
Median thyrohyoid ligament
thyroid cartilage
Thyrocricoid ligament
cricoid cartilage

Cartilages of the Larynx

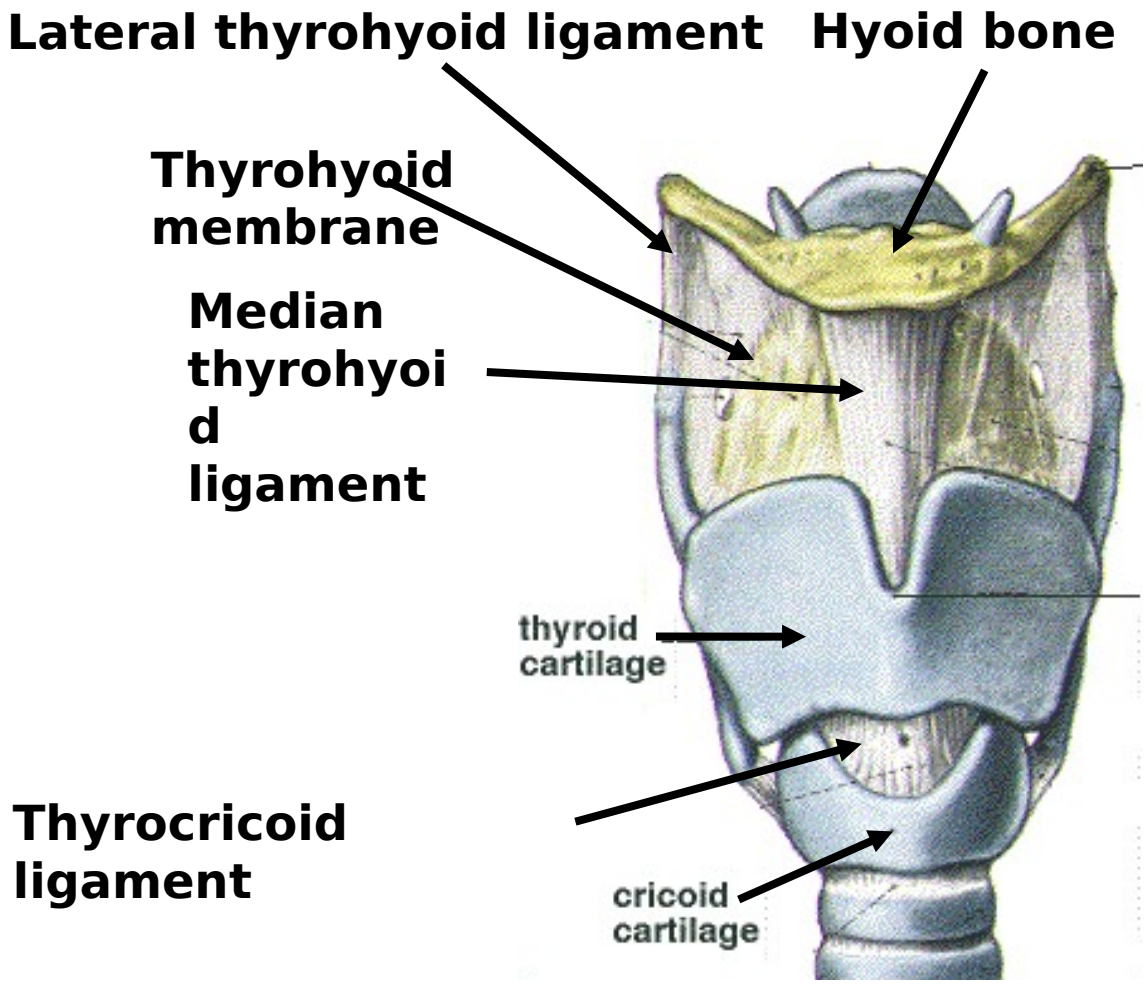
Thyrohyoid membrane (Extrinsic Membrane)

Provide extensive connection between the thyroid cartilage and the hyoid bone bilaterally and anteriorly.

Extend from the upper border of thyroid cartilage to the hyoid bone.

Thicken anteriorly forming the **median thyrohyoid ligament.**

Thicken laterally forming the **lateral thyrohyoid ligament**.


Lateral thyrohyoid ligament
Hyoid bone
Thyrohyoid membrane
Median thyrohyoid ligament
thyroid cartilage
Thyrocricoid ligament
cricoid cartilage

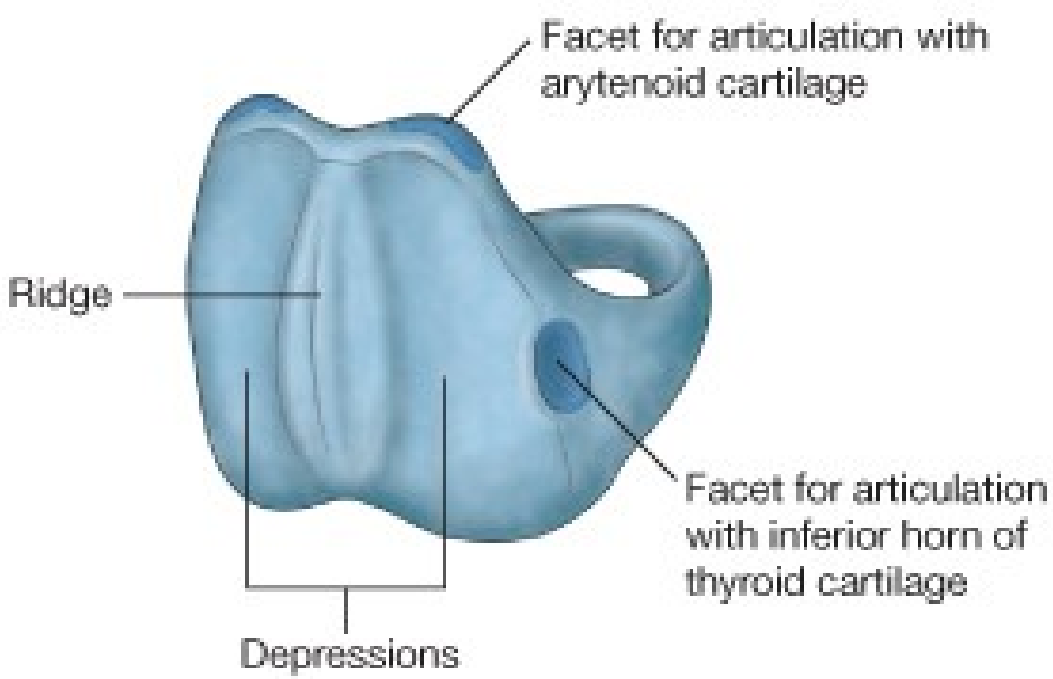
Cricoid Cartilage

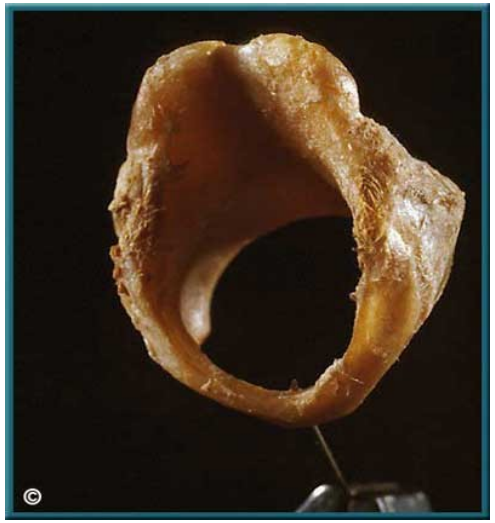
Signet ring shaped hyaline cartilage with a **narrow arch in front** and **broad lamina posteriorly.**

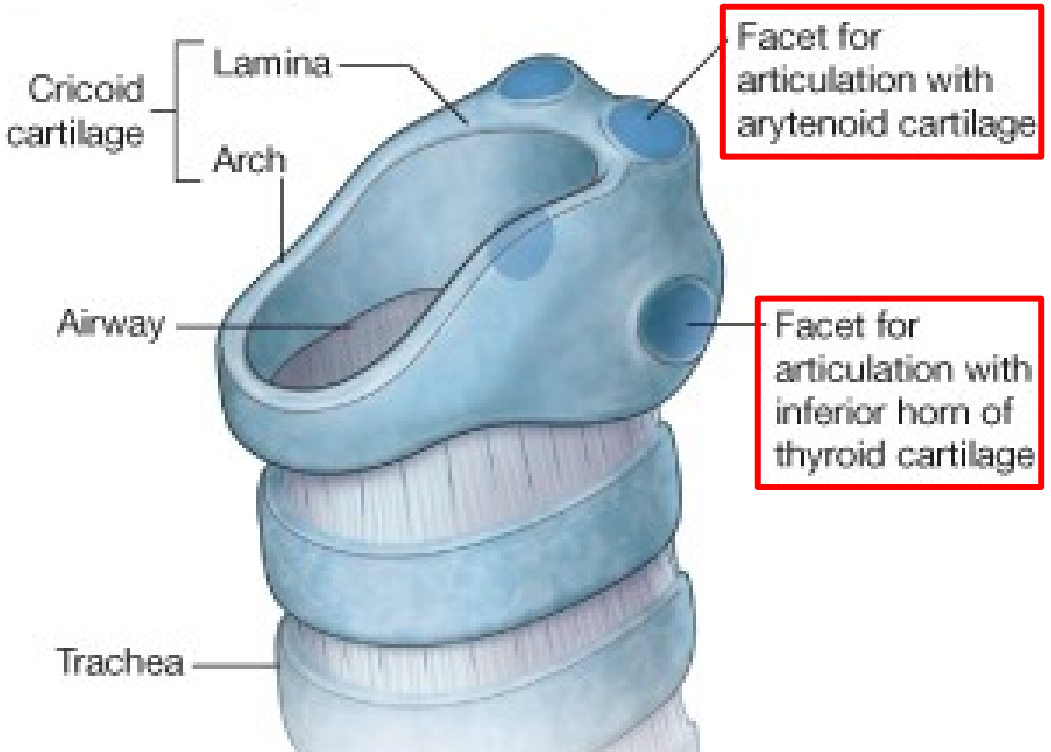
Lies at the level of C6 vertebra and its lower border marks the end of larynx.

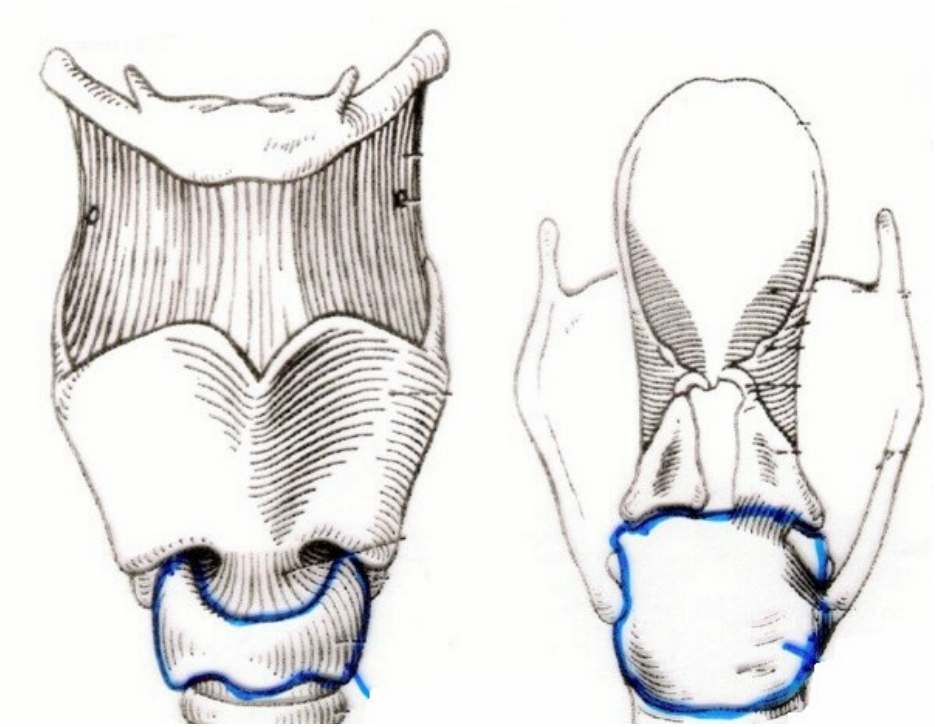
Stronger than thyroid cartilage.

Considerably broader posteriorly than anterior arch.


Facet for articulation with arytenoid cartilage
Ridge
Facet for articulation with inferior horn of thyroid cartilage
Depressions


©


Cricoid cartilage
Lamina
Arch
Airway
Trachea
Facet for articulation with arytenoid cartilage
Facet for articulation with inferior horn of thyroid cartilage



Epiglottis

Leaf shaped ***elastic cartilage***, attached by its stem to the posterior aspect of the thyroid cartilage by the thyro-epiglottic ligament.

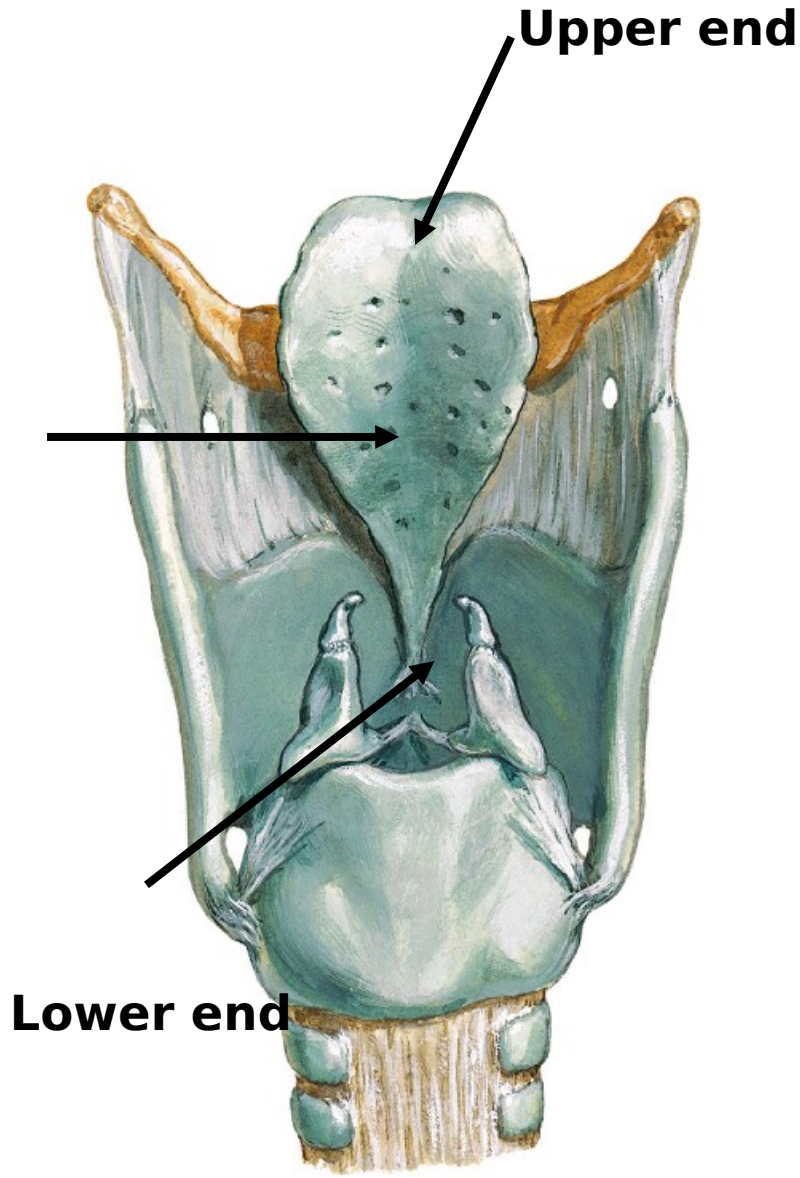
The upper free end broad extends up behind the hyoid bone and the base of the tongue.

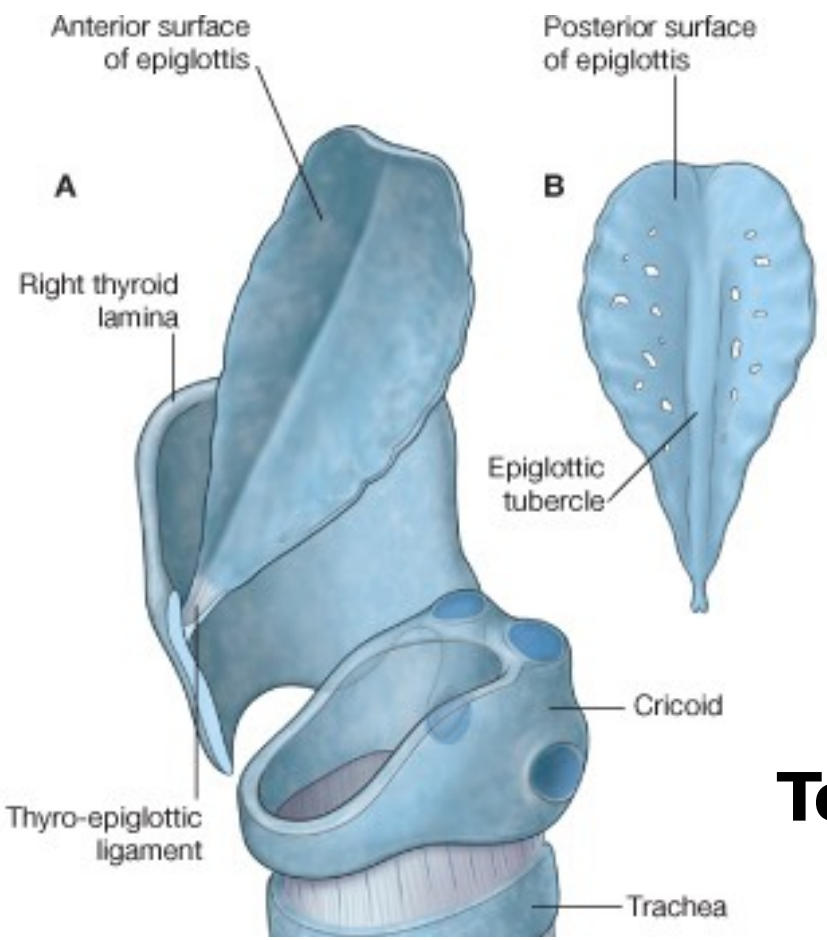
Epiglottis

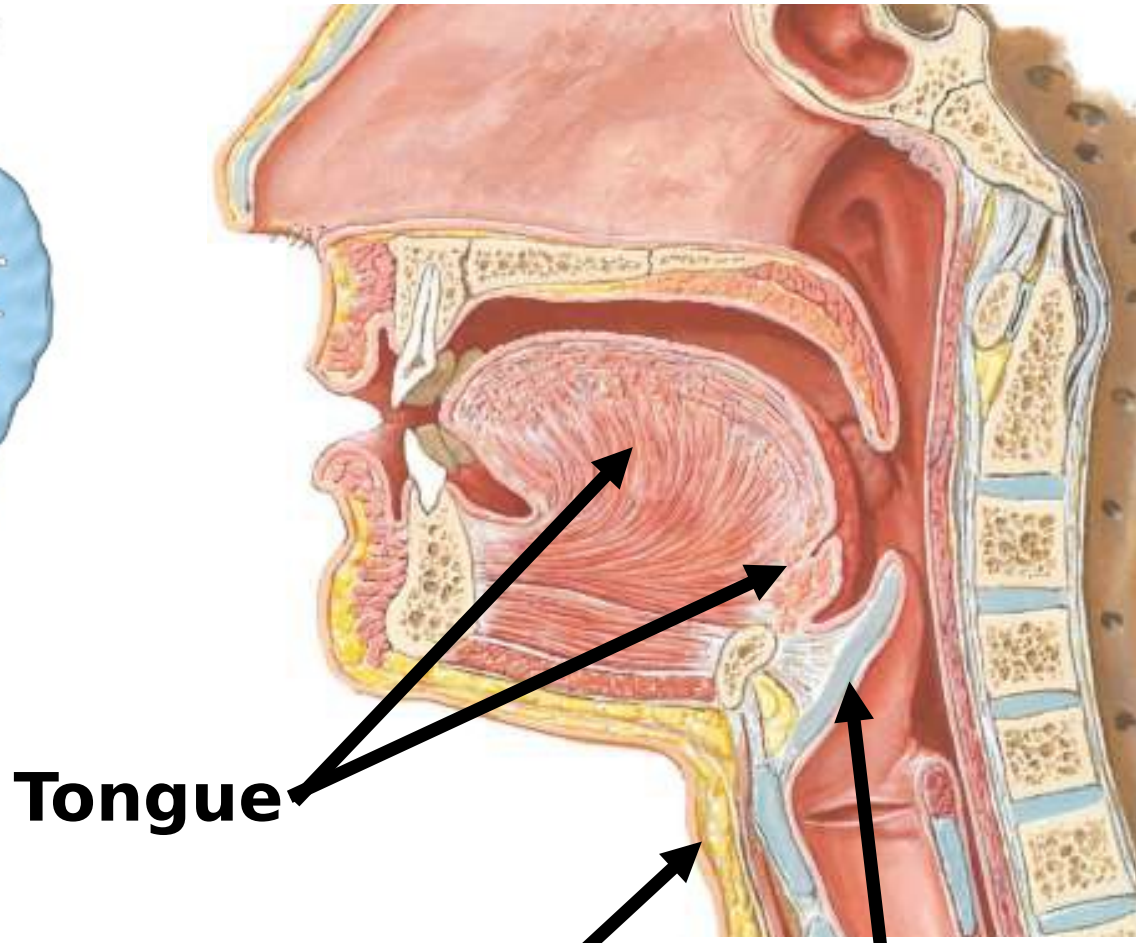
Narrow lower end attached to thyroid by thyro-epiglottic ligament

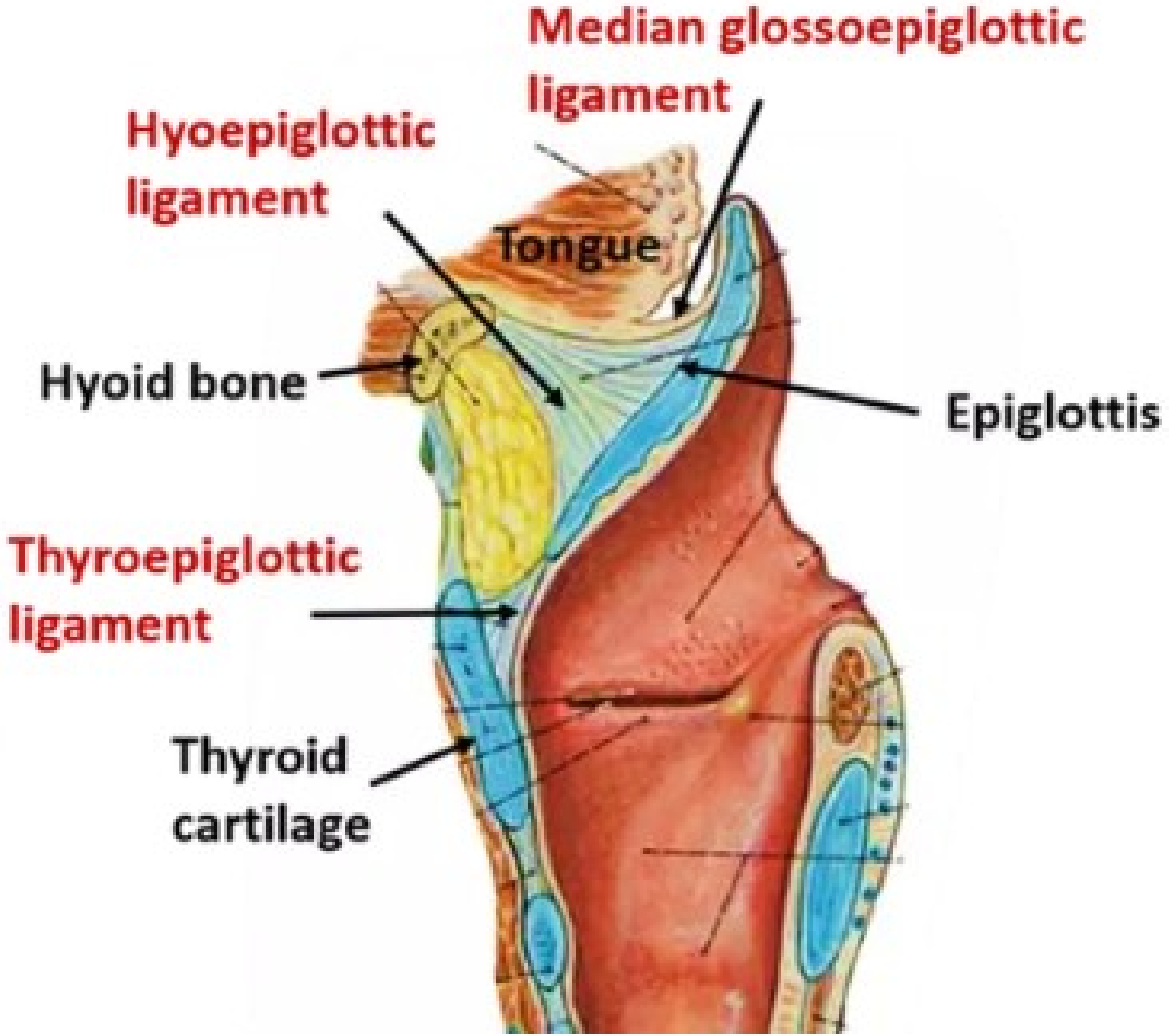
Anterior surface : upper part gives attachment to median and lateral glossoepiglottic folds lower part is connected to hyoid by hyoepiglottic ligament

Posterior surface : shows pits of mucus glands




Anterior surface of epiglottis
Posterior surface of epiglottis
A
B
Right thyroid lamina
Epiglottic tubercle
Cricoid
Thyro-epiglottic ligament
Trachea

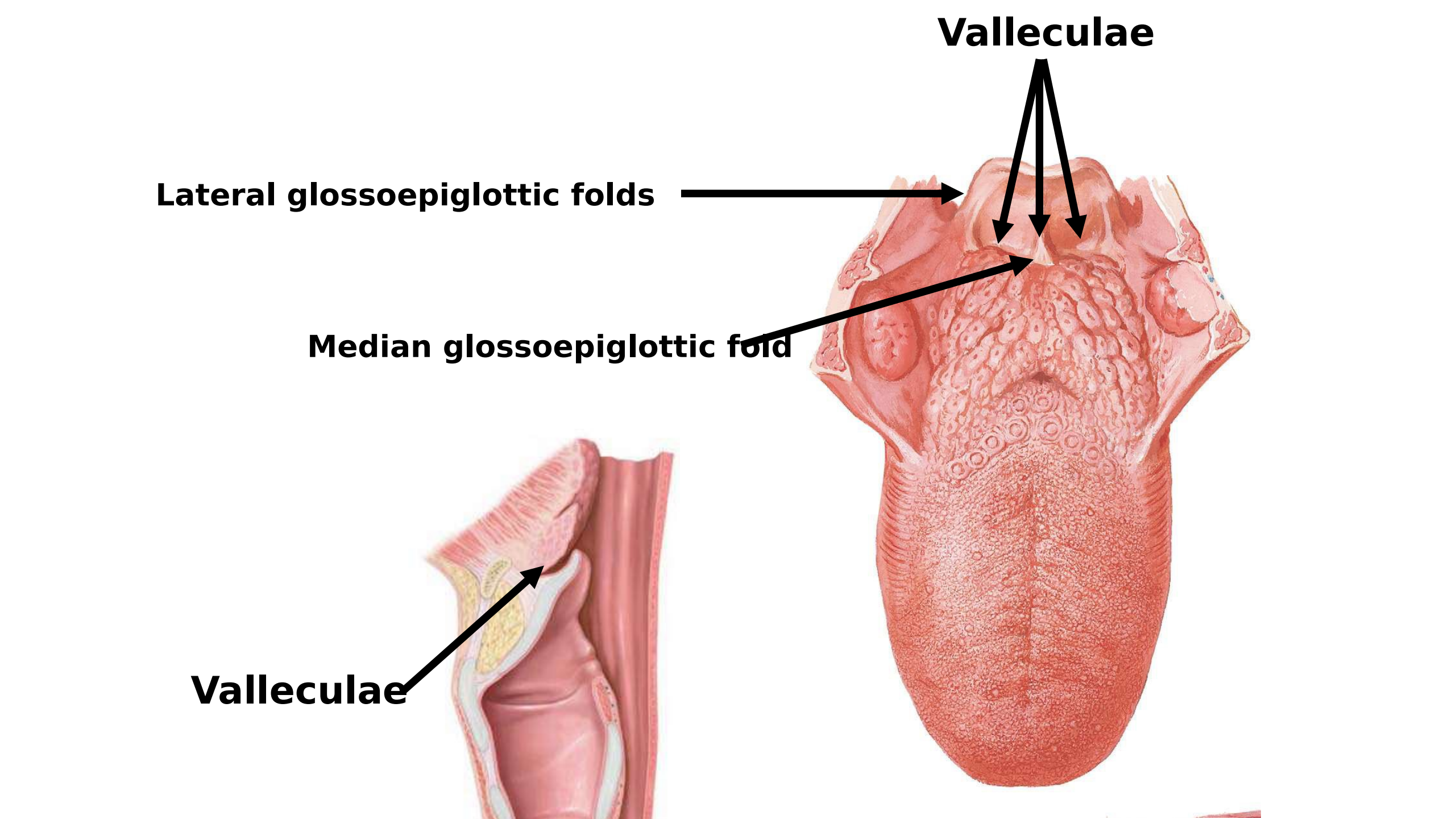

Tongue
Hyoid bone
Epiglottis


Median glossoepiglottic ligament
Hyoepiglottic ligament
Tongue
Hyoid bone
Epiglottis
Thyroepiglottic ligament
Thyroid cartilage

Epiglottis

- The anterior surface of epiglottis is connected with the base of the tongue by ***median*** and ***lateral glossoepiglottic folds***.

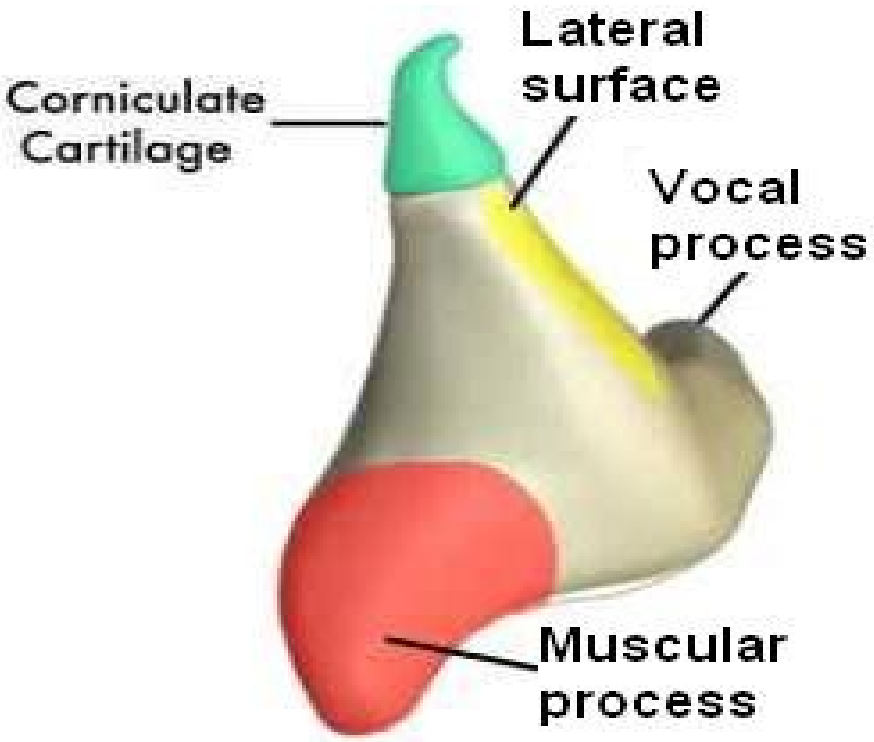
- Between these folds are depressions called ***epiglottic valleculae***.


Valleculae
Lateral glossoepiglottic folds
Median glossoepiglottic fold
Valleculae

Paired Cartilages

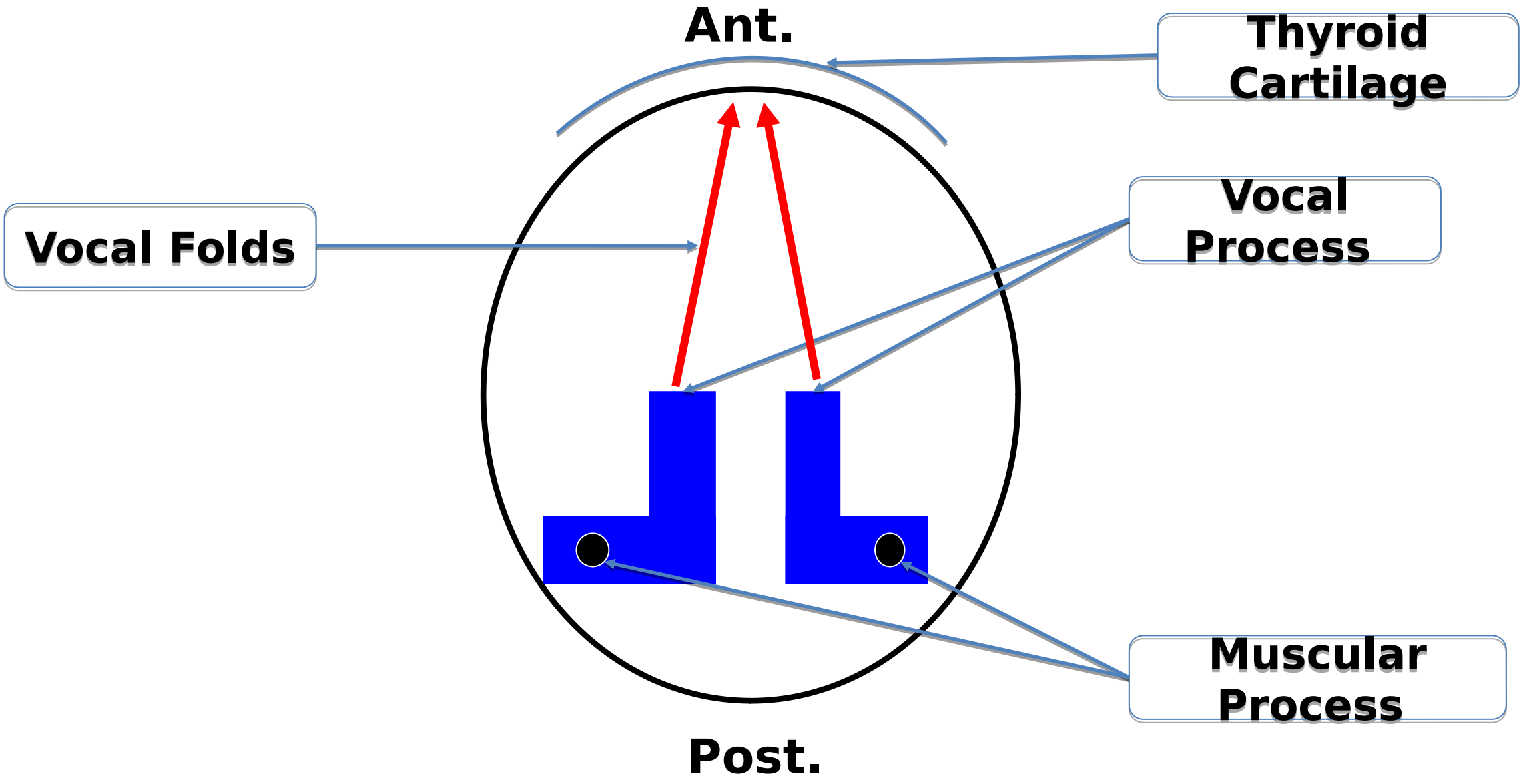
Arytenoid cartilage

- Pyramidal in shape
- Base articulates with cricoid lamina
- Apex articulates with corniculat
- It has 2 processes muscular lateral and vocal process anteri



Cuneiform cartilage

Corniculate cartilage

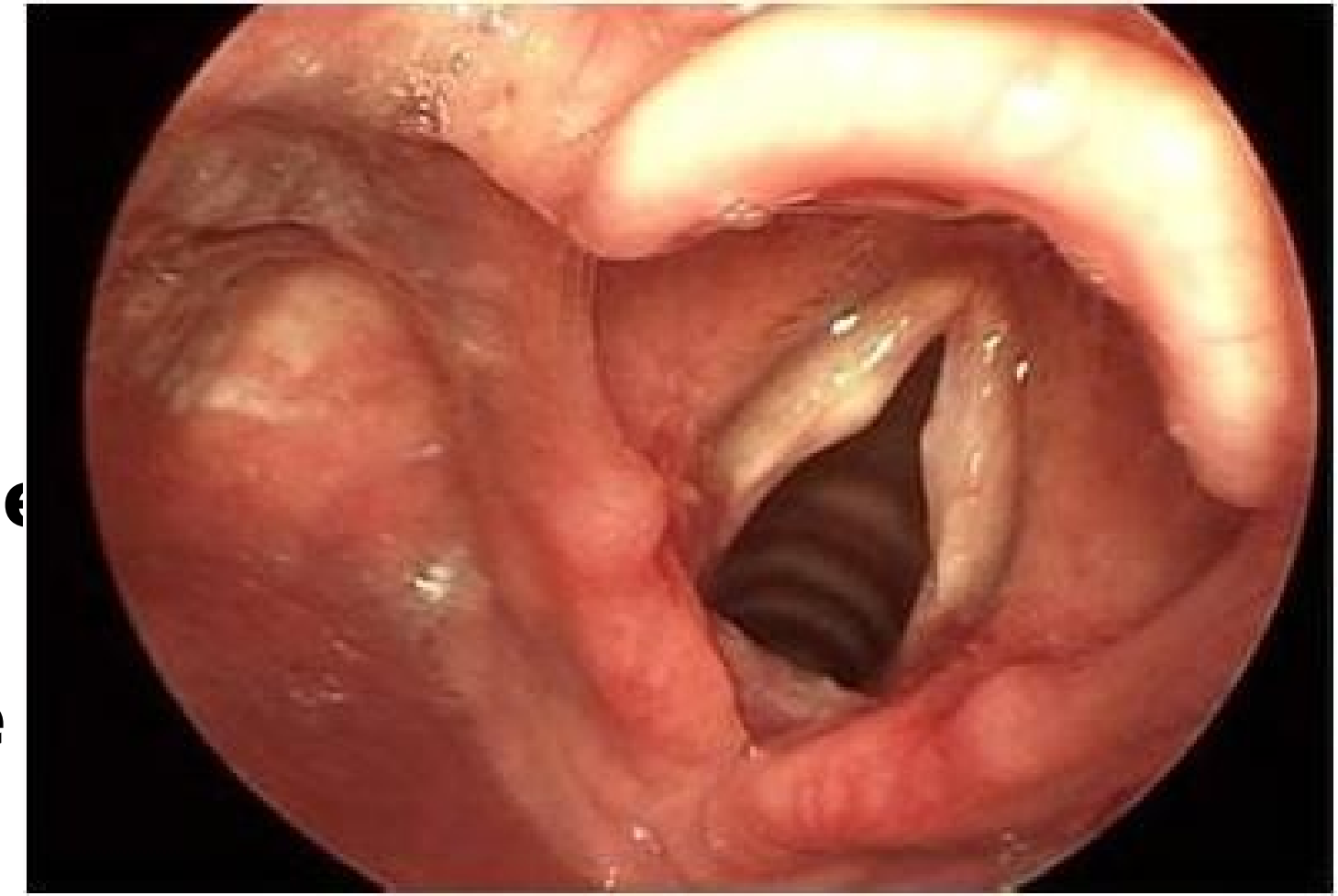

Ant.
Thyroid Cartilage
Vocal Folds
Vocal Process
Muscular Process
Post.

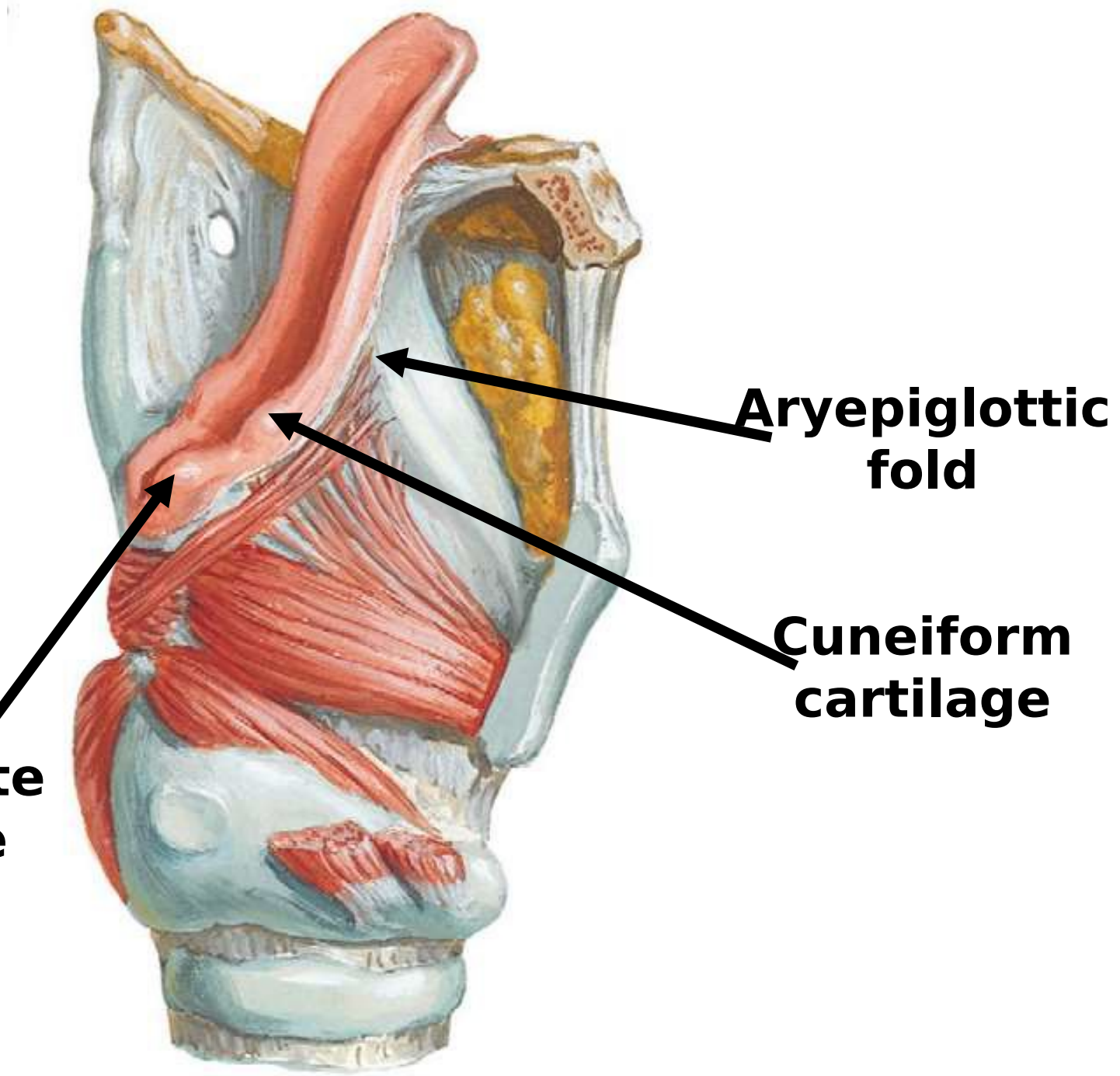
Paired Cartilages

Arytenoid cartilage

Corniculate cartilage

Cuneiform cartilage




Aryepiglottic fold
Cuneiform cartilage
Corniculate cartilage

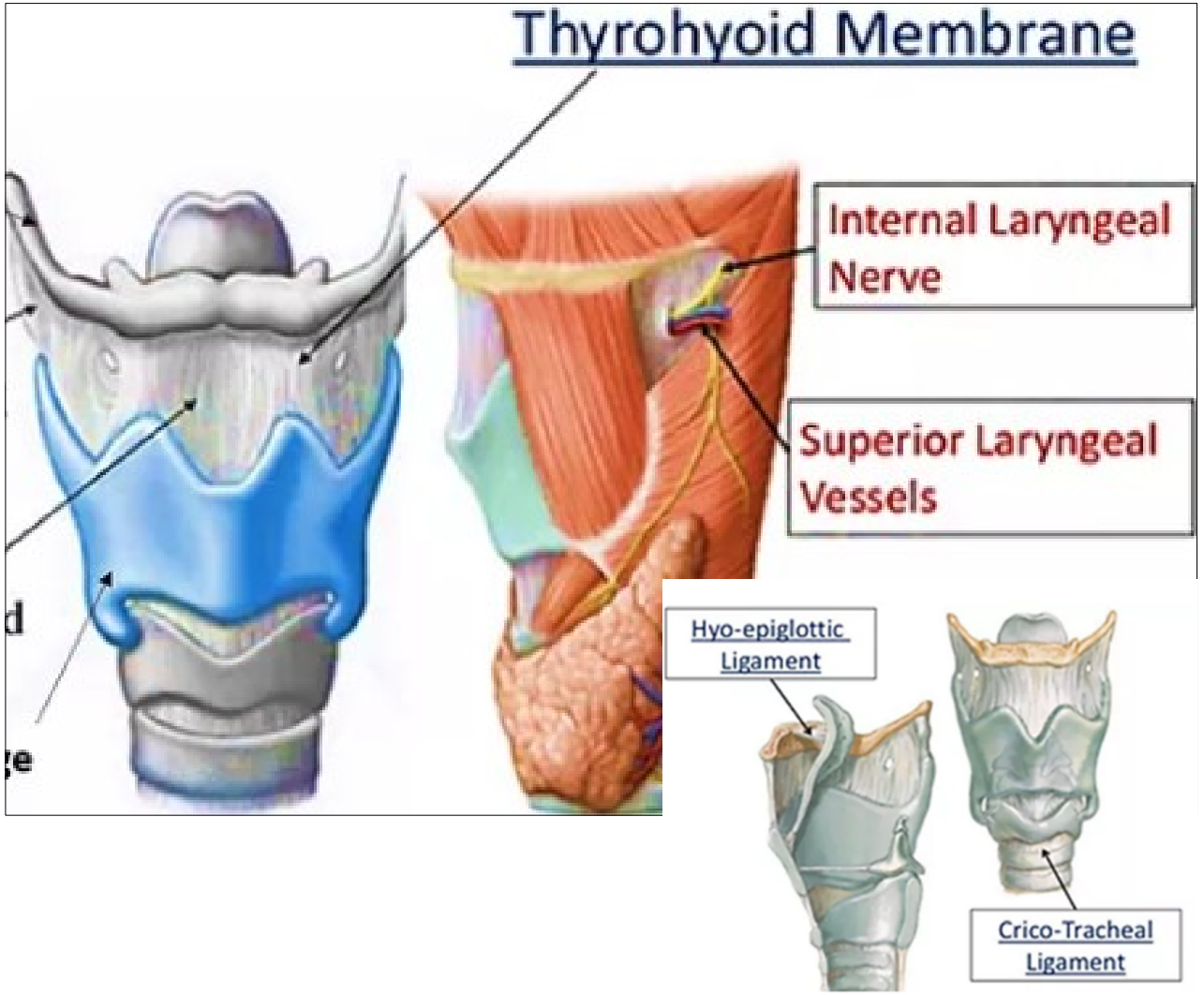
Extrinsic Ligaments and Membranes of Larynx

Thyrohyoid membrane

Spans between the superior margin of the thyroid cartilage below and the hyoid bone above.

Crico-tracheal ligament

Runs from the lower border of the cricoid cartilage to the adjacent upper border of the first tracheal cartilage



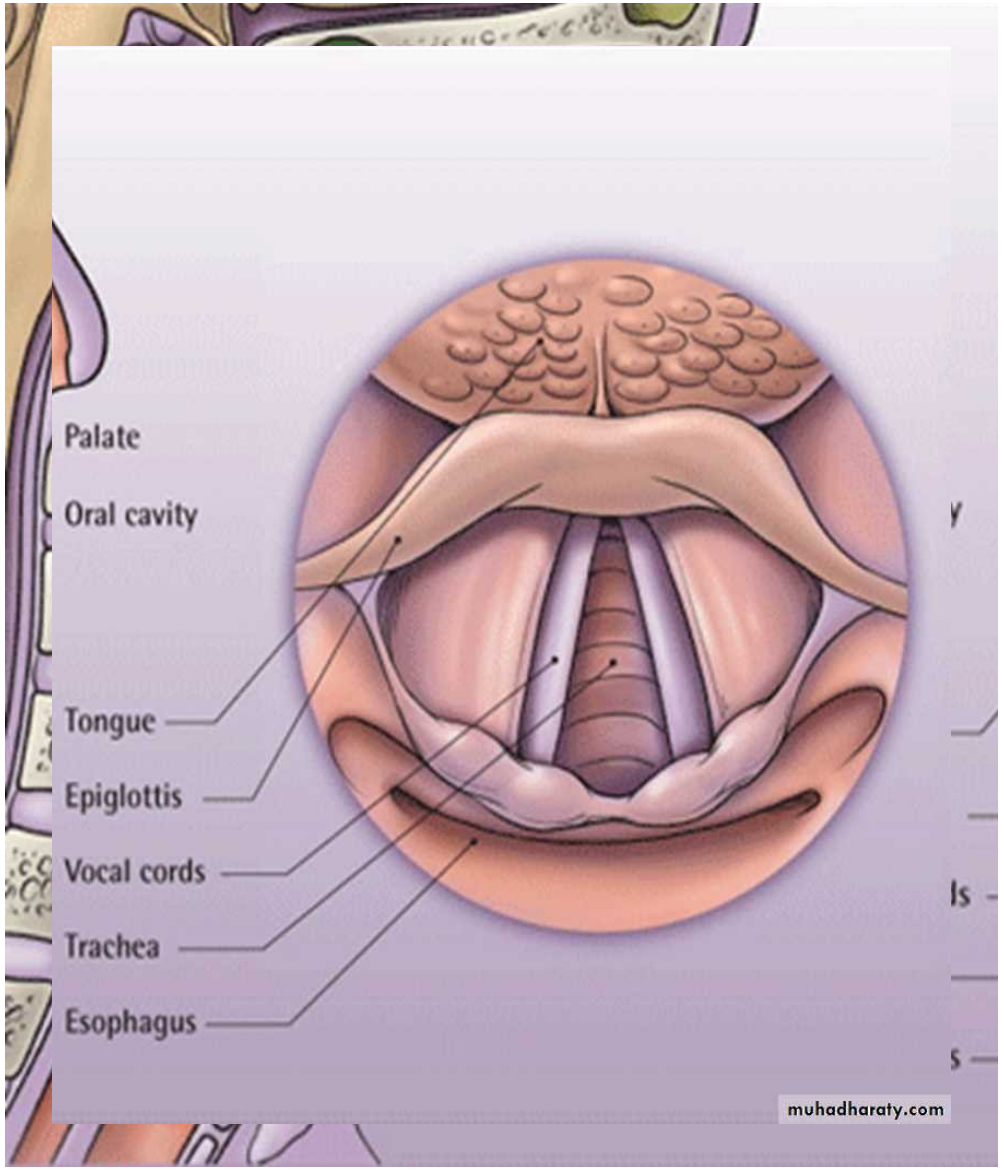
Laryngeal Inlet

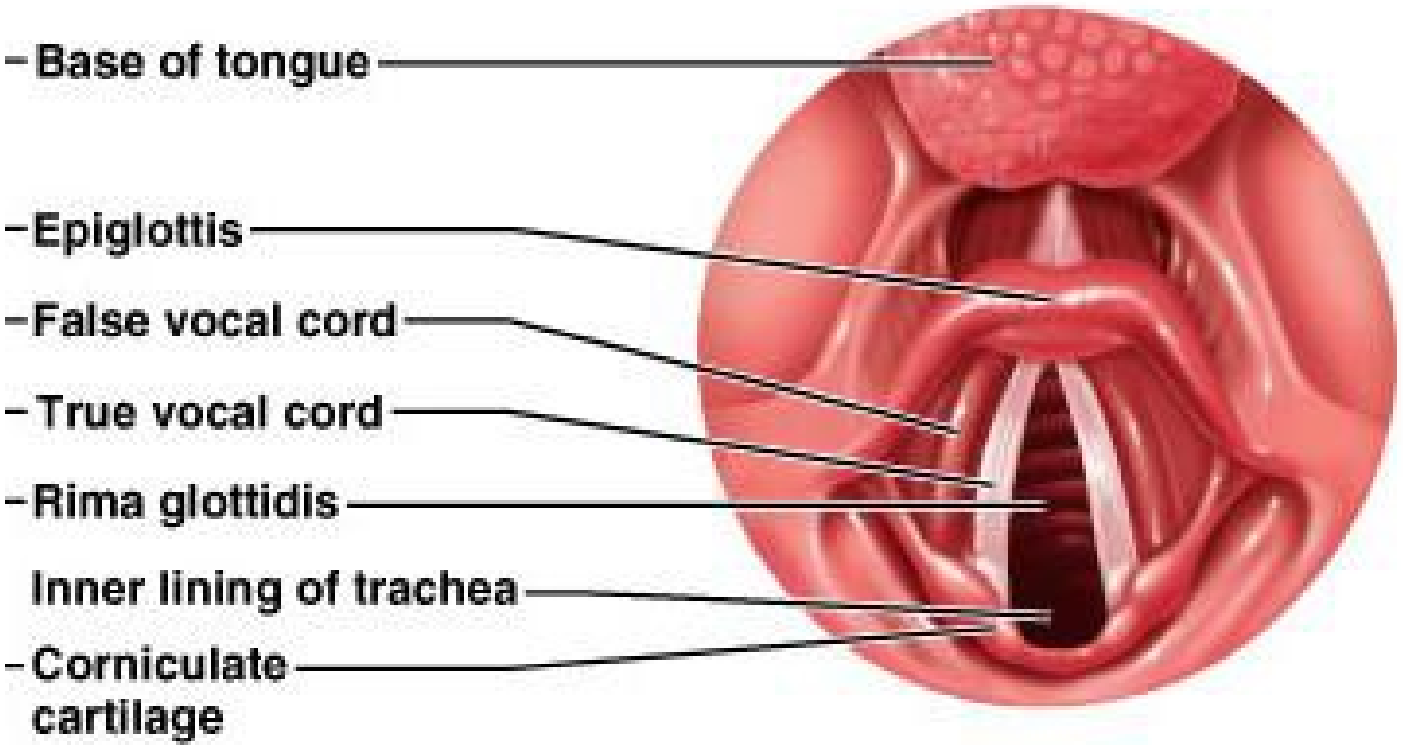
It is **the superior aperture**
Below and posterior to the **tongue**
Anterior to **pharynx**

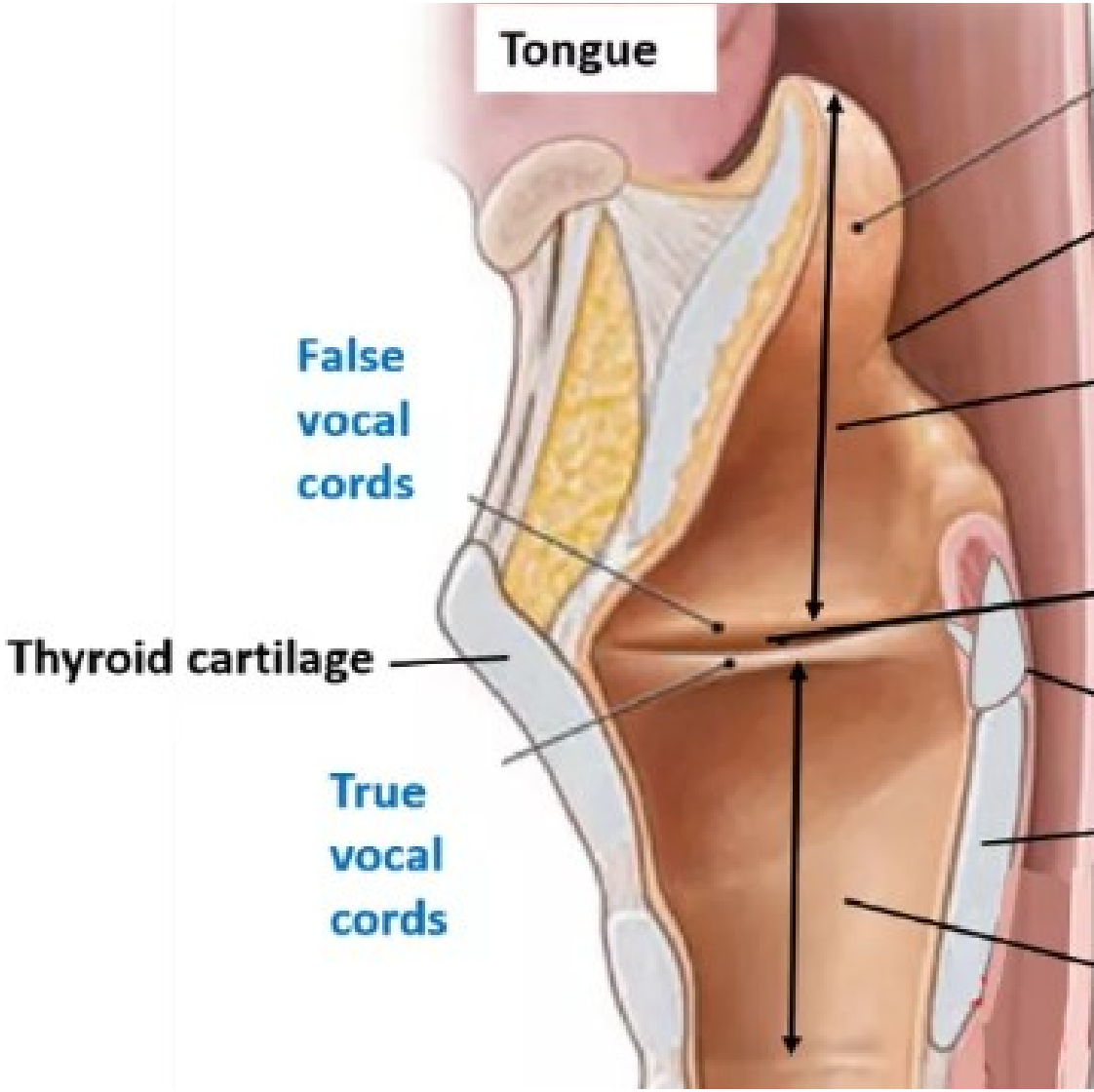
Anterior border → **epiglottis**

Lateral borders → **(aryepiglottic folds)**

Posterior border →
Mucosal fold between the two corniculate tubercles




Base of tongue
Epiglottis
False vocal cord
True vocal cord
Rima glottidis
Inner lining of trachea
Corniculate cartilage


Tongue
False vocal cords
Thyroid cartilage
True vocal cords

Laryngeal Cavity

The subdivisions of laryngeal cavity

The cavity of larynx is subdivided into three parts by two pairs of folds, the upper vestibular fold and the lower vocal folds:

Supraglottic part / Vestibule: It extends from laryngeal inlet to vestibular folds.

Ventricle (sinus of larynx): It is a deep elliptical space between vestibular and vocal folds.

Infraglottic part: It extends from vocal cords to lower border of cricoid cartilage.

Laryngeal Cavity

The saccule of larynx (Sinus)

It is a blind diverticulum that extends upward from the anterior part of ventricle between the vestibular folds and lamina of thyroid cartilage.

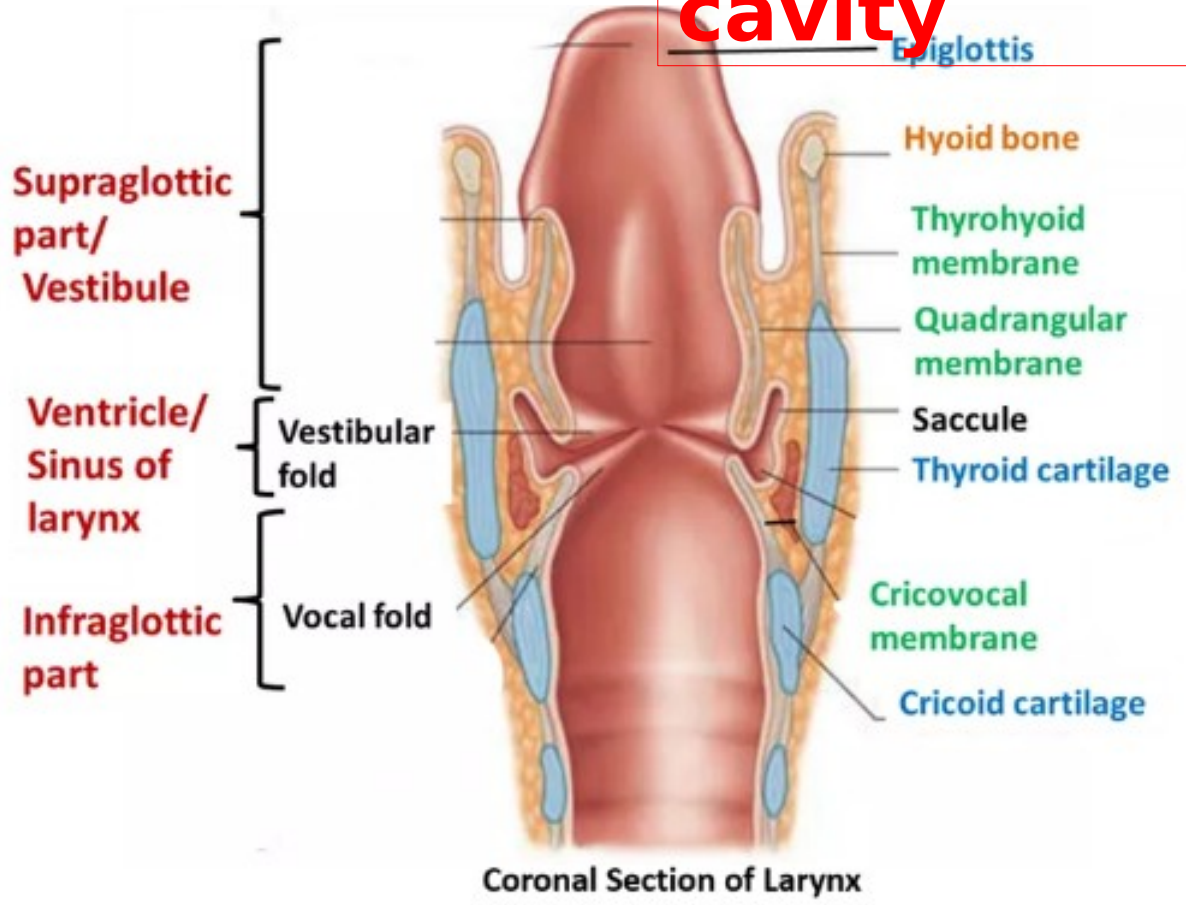
It contains numerous **mucus gland** in the submucosal tissue.

The glandular secretion of the saccule **keep the vocal cord moist and lubricated**.

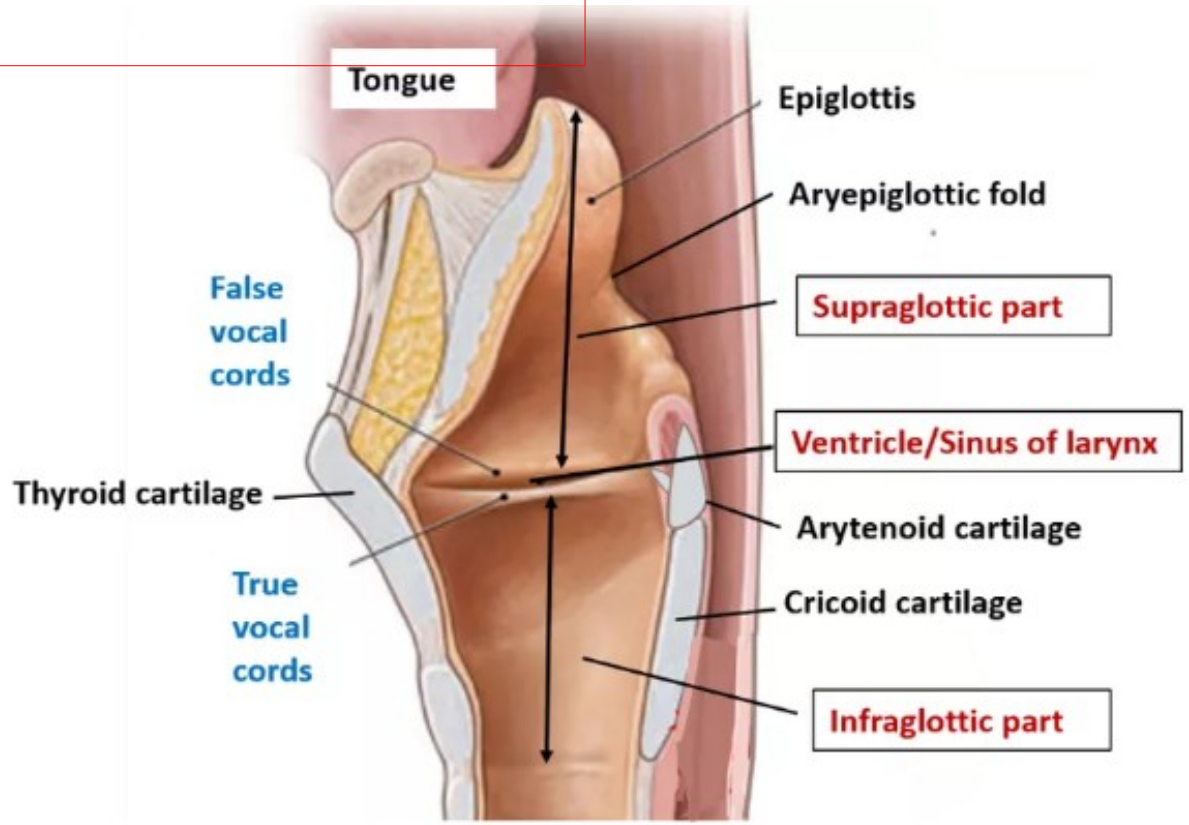
Known as the **oil can of the larynx.**

Laryngeal Cavity: ***Extends from laryngeal inlet above to lower border of cricoid cartilage.***

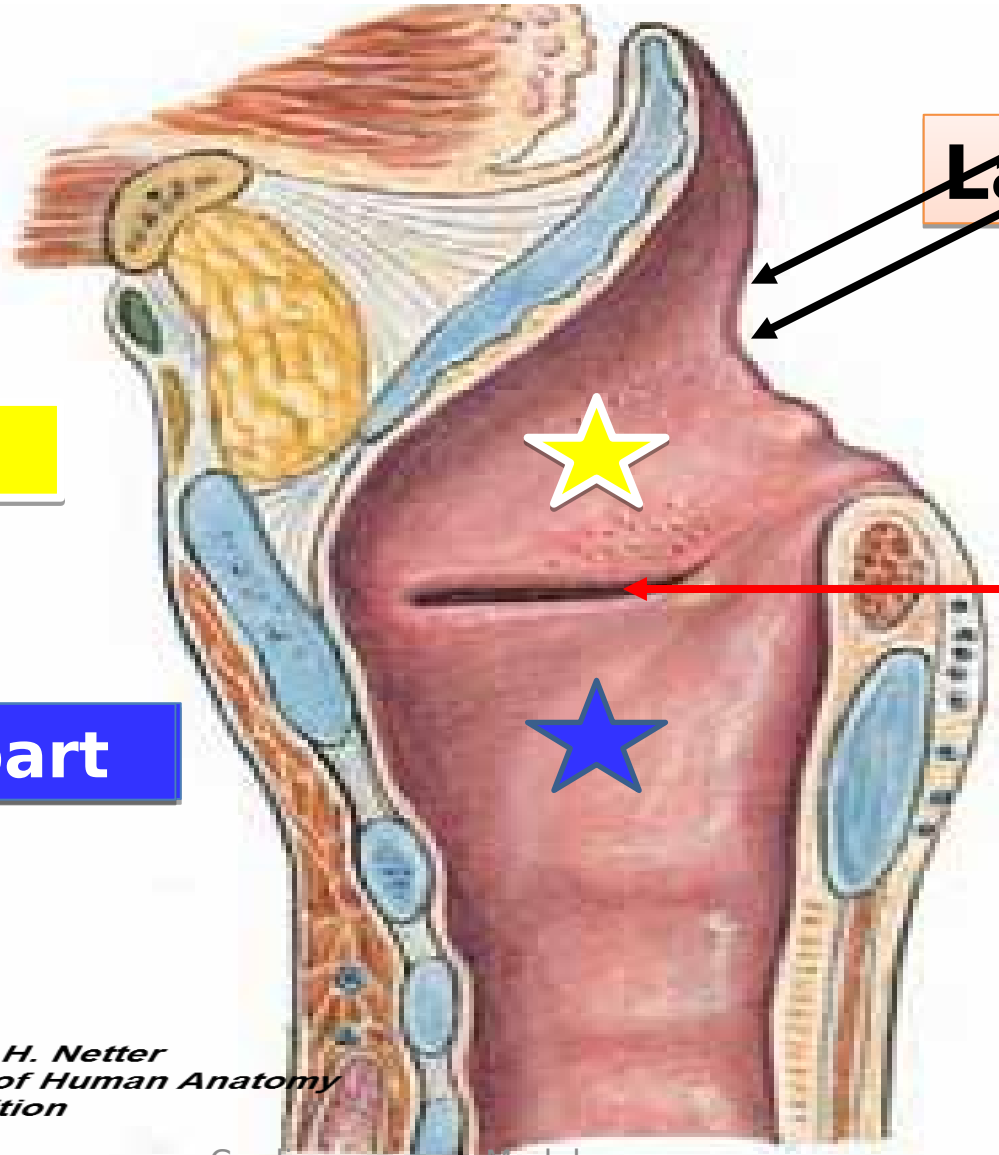
Subdivisions of laryngeal cavity



Coronal Section of Larynx



Sagittal section of Larynx



Cardiopumonary Module

False Vocal Cords/ Vestibular folds

They are called so because they **don’t take part phonation**.

They are **fixed** on each side of the larynx.

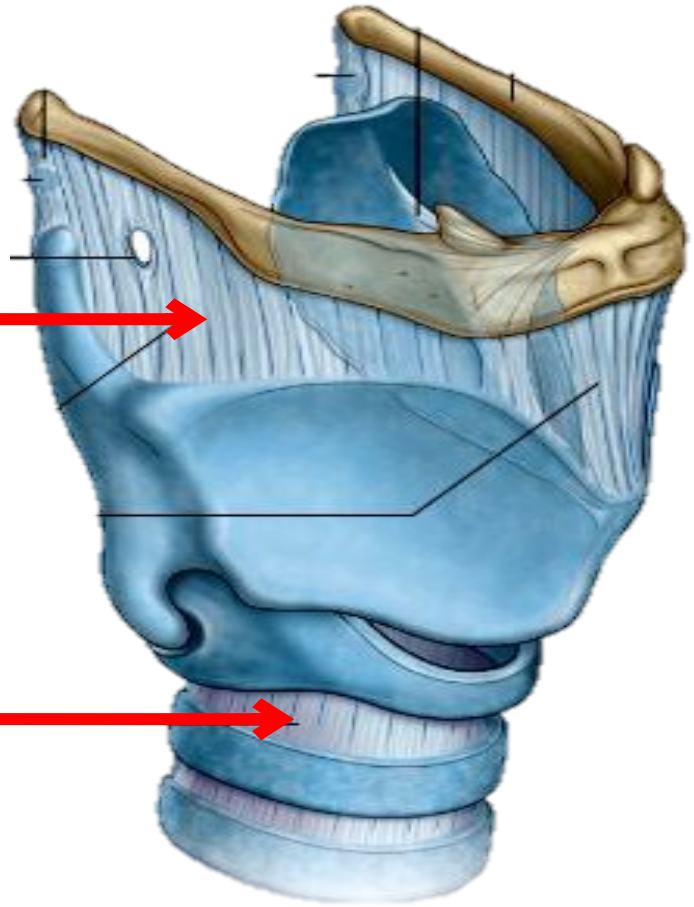
Formed of mucus membrane covering the vestibular ligament

They are ***vascular*** and ***pink*** **in** ***color*** **(in Laryngoscopy)**.

Extrinsic Ligaments and Membranes of Larynx

1-Thyro-hyoid membrane

2- Crico-tracheal ligament

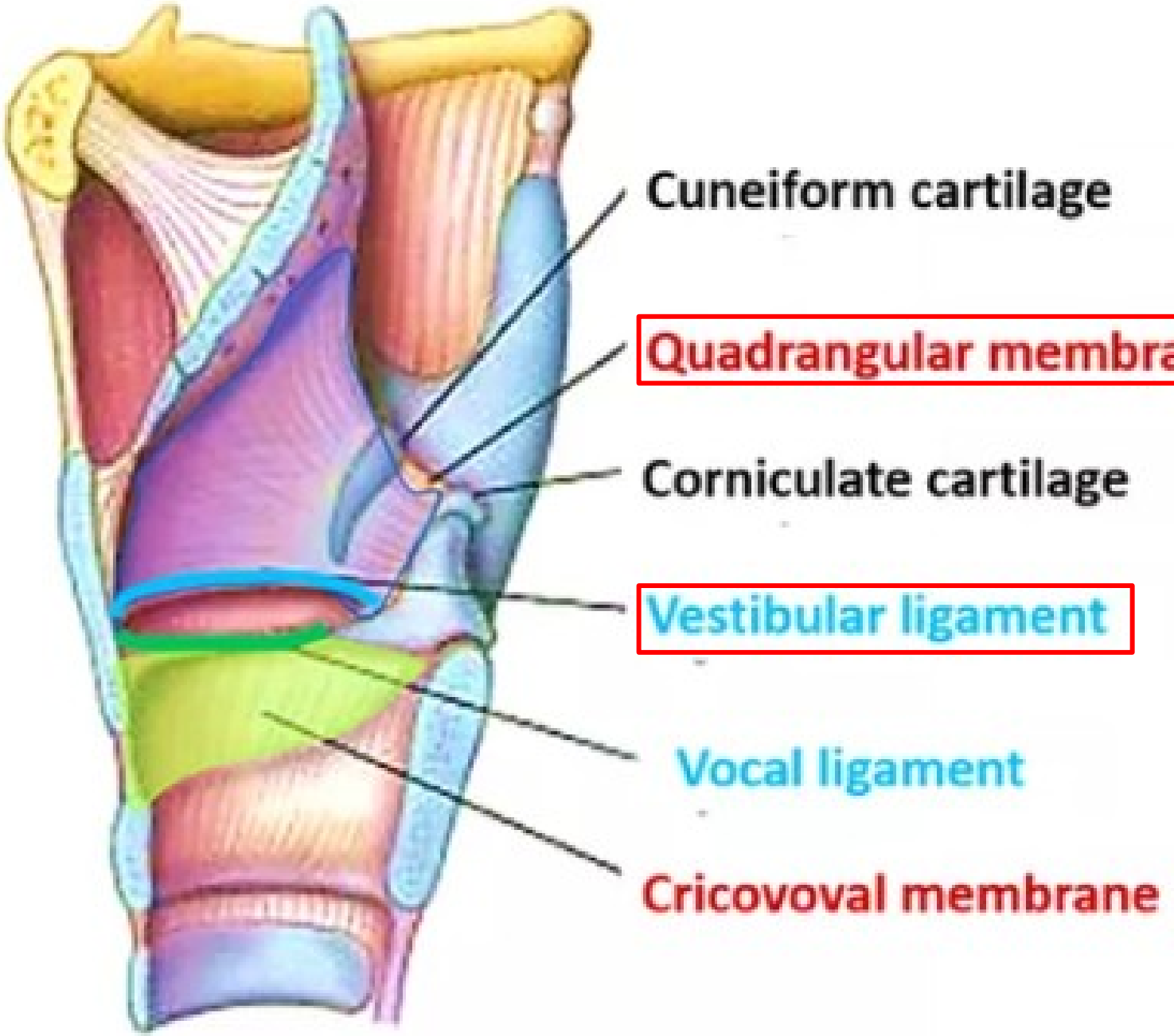


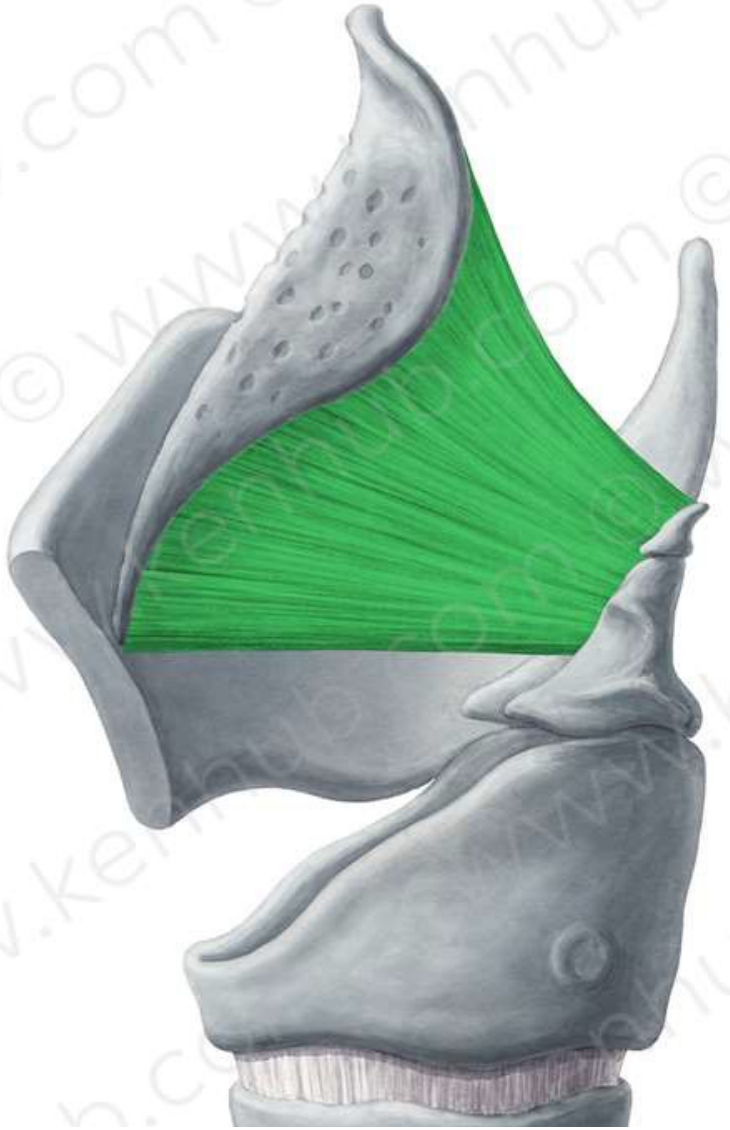
Intrinsic Ligaments and Membranes of Larynx

Quadrangular membrane

Extends between the lateral margin of the epiglottis to **arytenoid** and **corniculate** cartilage on the same side

Each quadrangular membrane has an upper free margin ***"aryepiglottic fold"*** and a lower free margin ***"vestibular folds – False vocal fold"***.

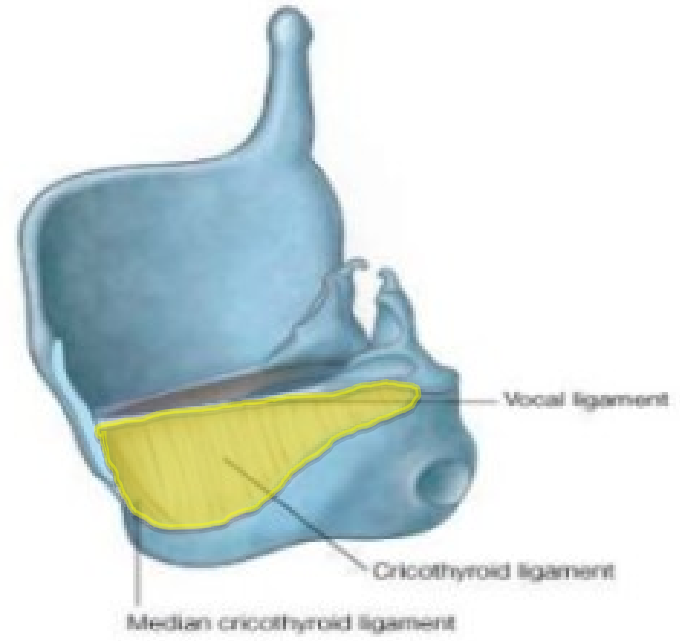

Cuneiform cartilage
Quadrangular membrane
Corniculate cartilage
Vestibular ligament
Vocal ligament
Cricovoval membrane



Intrinsic Ligaments and Membranes of Larynx

Cricothyroid membrane (Conus Elasticus)

Attached to **the arch of cricoid cartilage** and extends superiorly to end in a **free upper margin.**

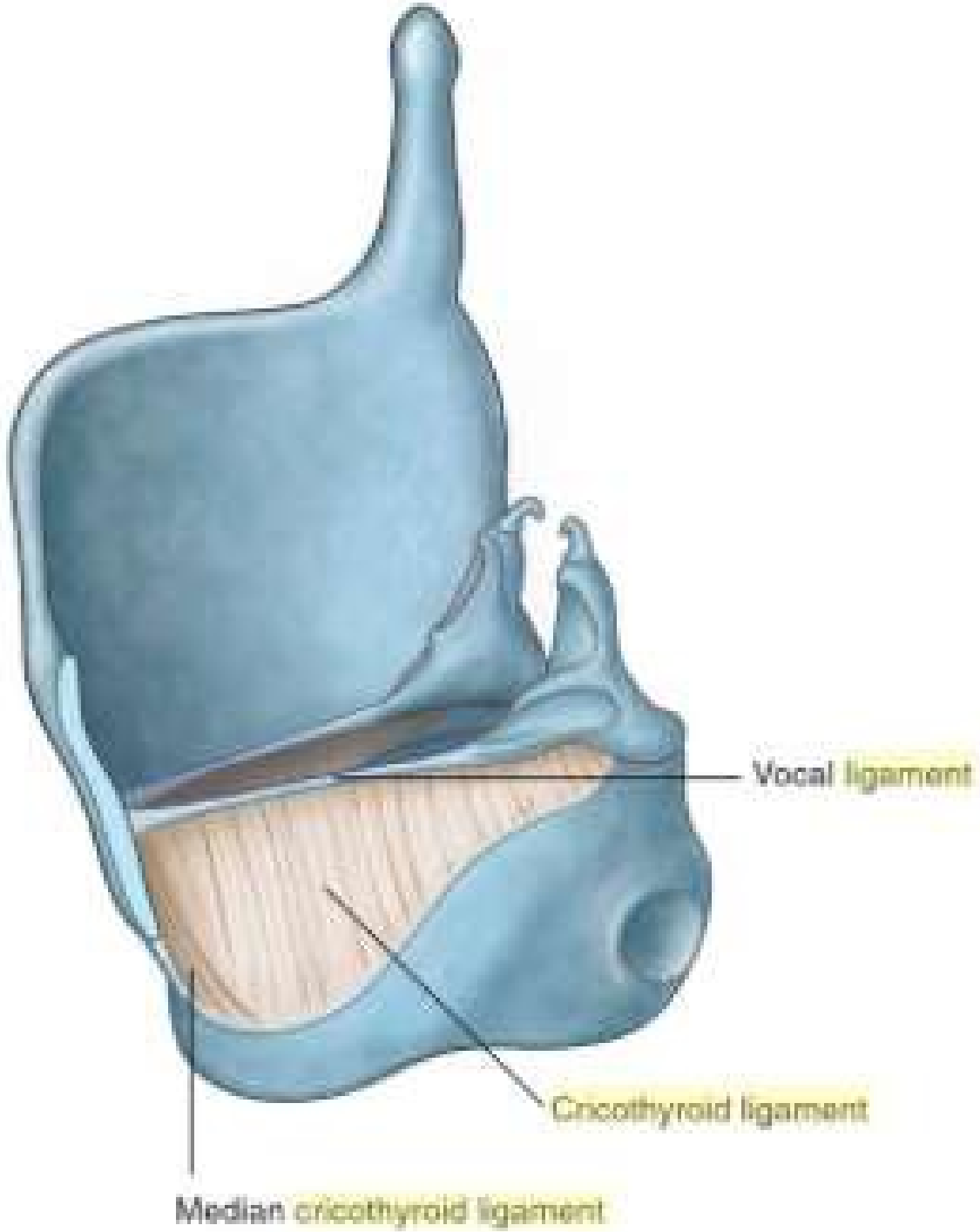


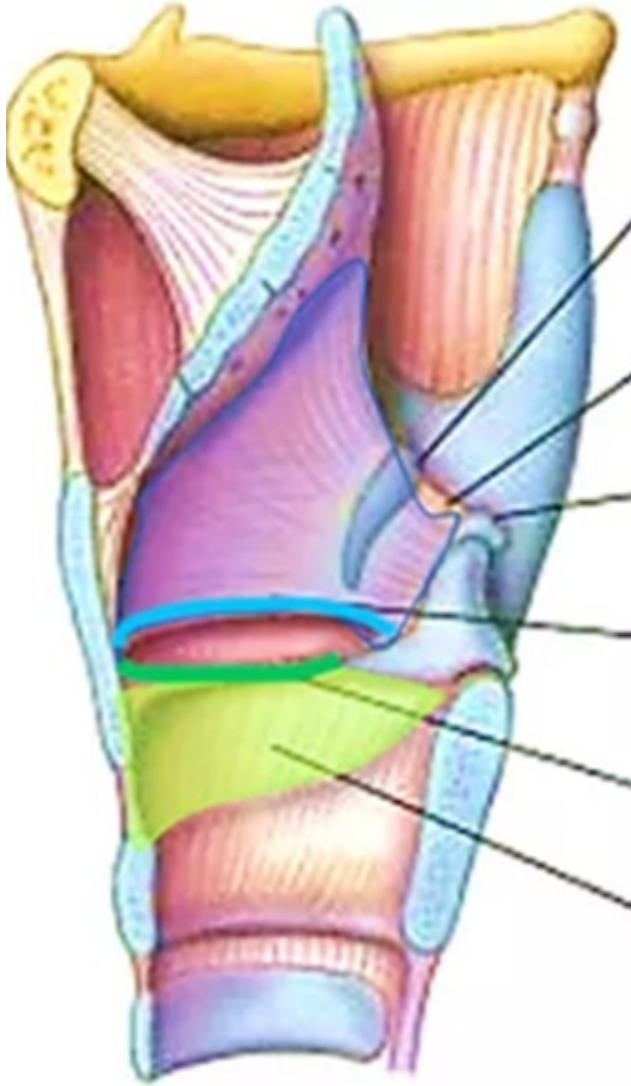
On each side, this upper free margin attaches:

1. Anteriorly to the thyroid cartilage.
2. Posteriorly to the **vocal processes** of the **arytenoid** cartilages

The upper free margin is also thickened to form the important **vocal ligament**, which is under **the vocal fold (true 'vocal cord')** of the larynx.

- Vocal folds are avascular
- No lymphatics
- Shining white cord
- Rich in elastic fibers





Cuneiform cartilage

Quadrangular membrane

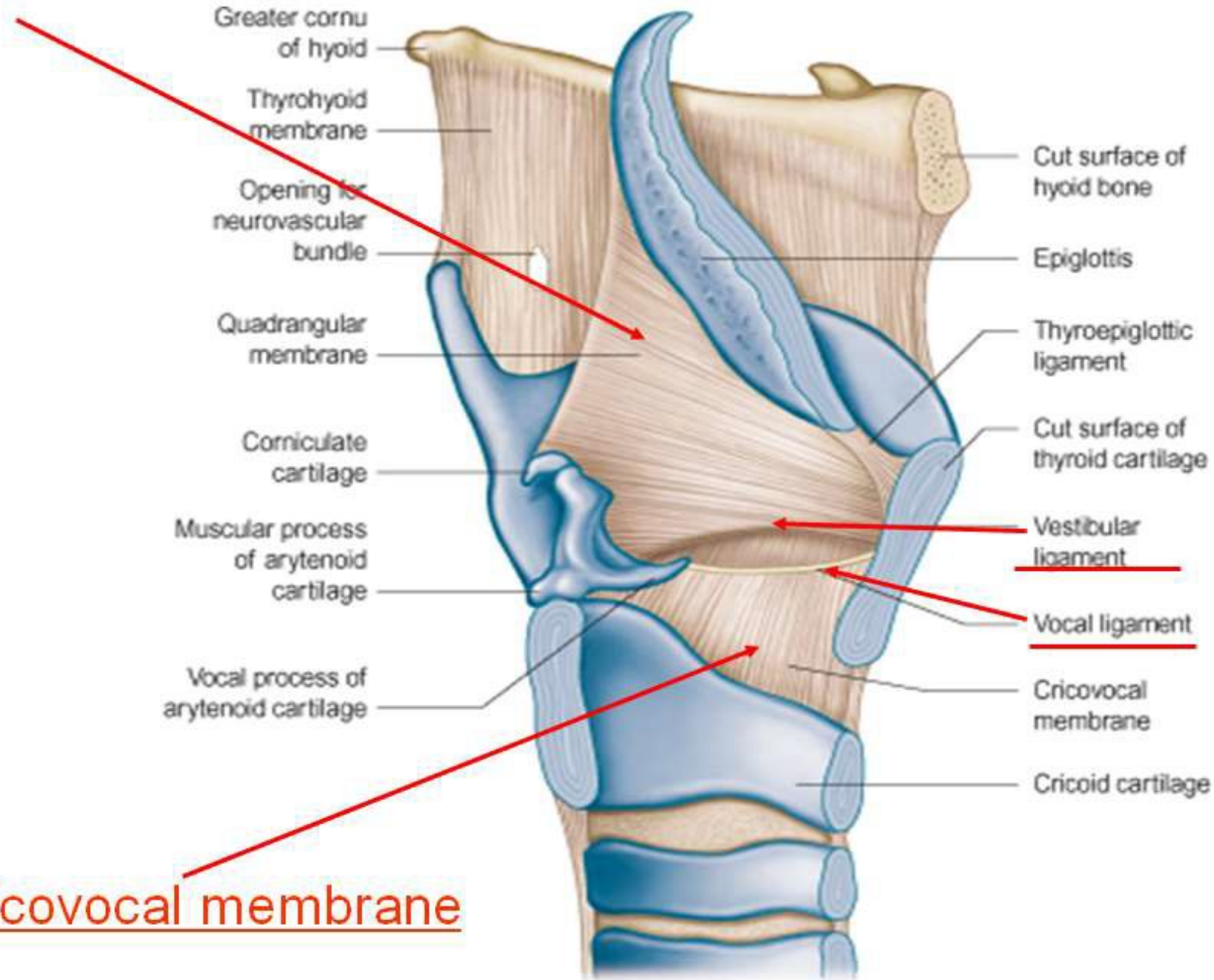
Corniculate cartilage

Vestibular ligament

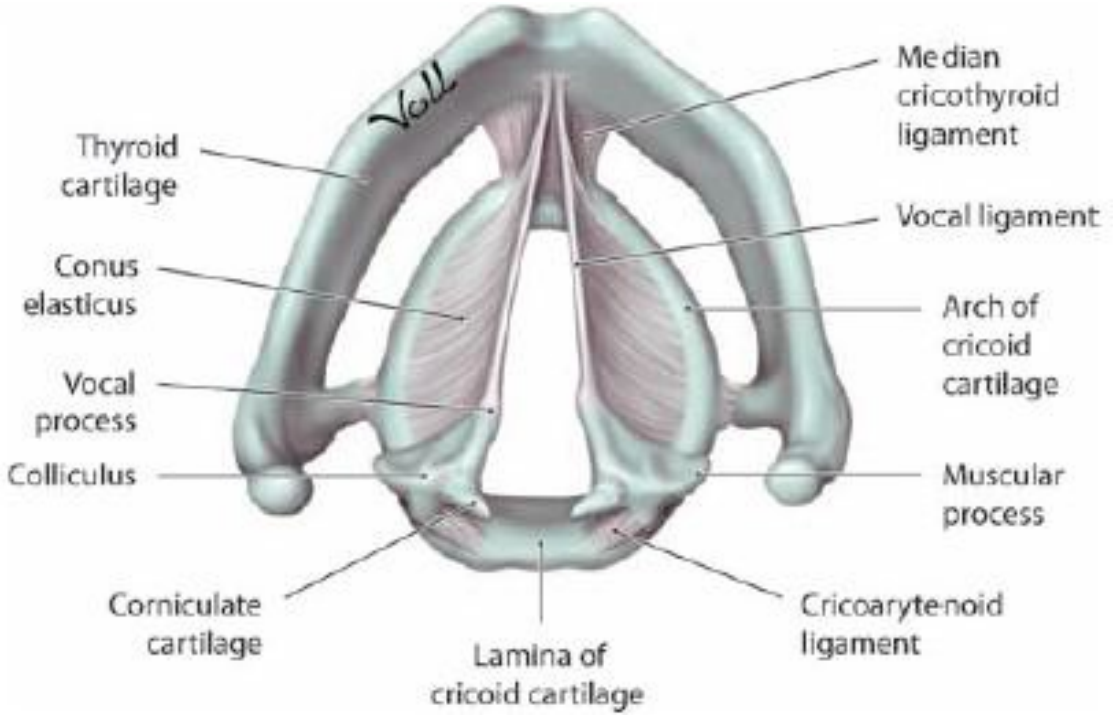
Vocal ligament

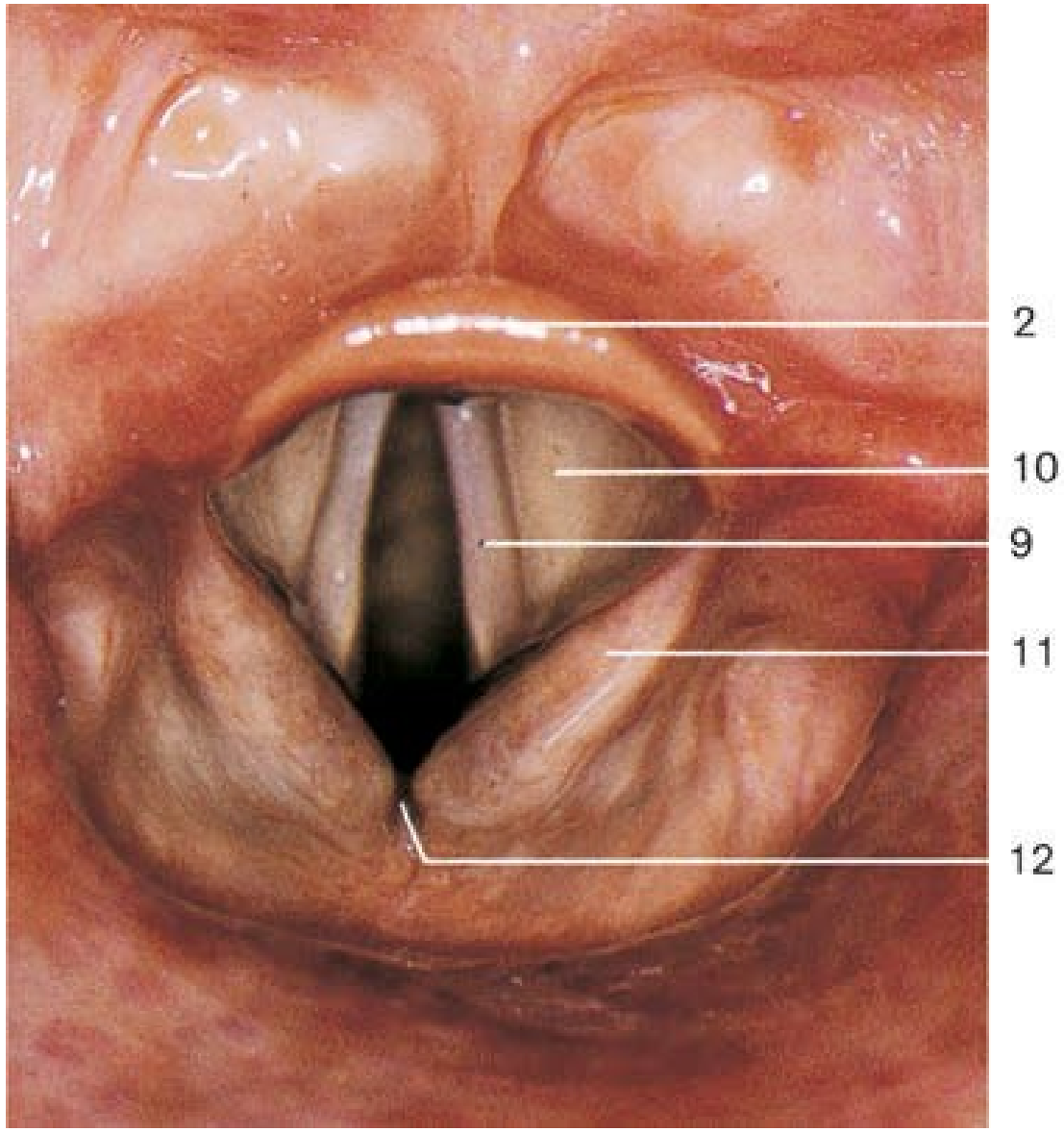
Cricovoval membrane

Quadrangular membrane



cricovocal membrane


Thyroid cartilage
Conus elasticus
Vocal process
Colliculus
Corniculate cartilage
Lamina of cricoid cartilage
Cricoarytenoid ligament
Muscular process
Arch of cricoid cartilage
Vocal ligament
Median cricothyroid ligament


2
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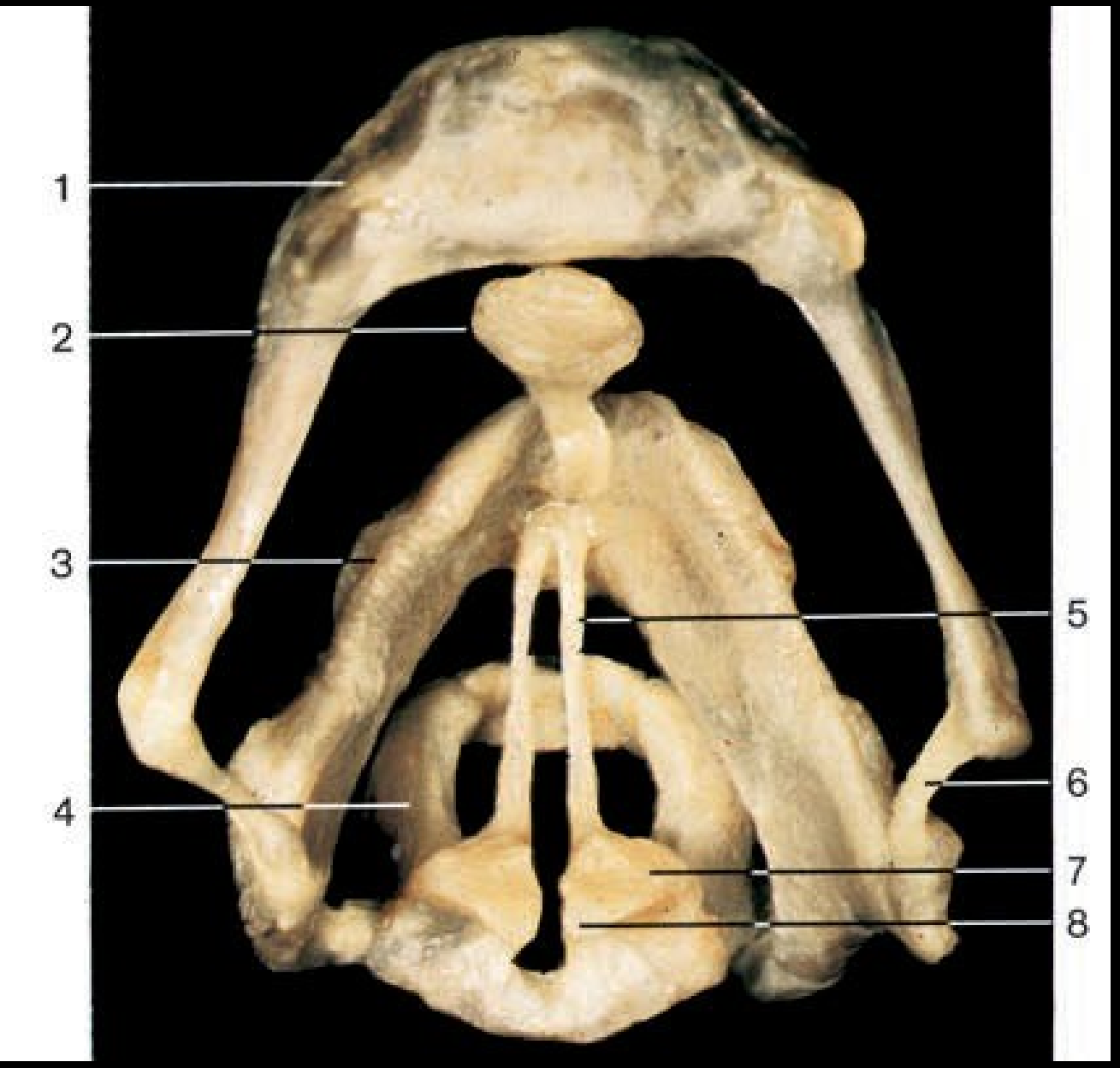
9
11
12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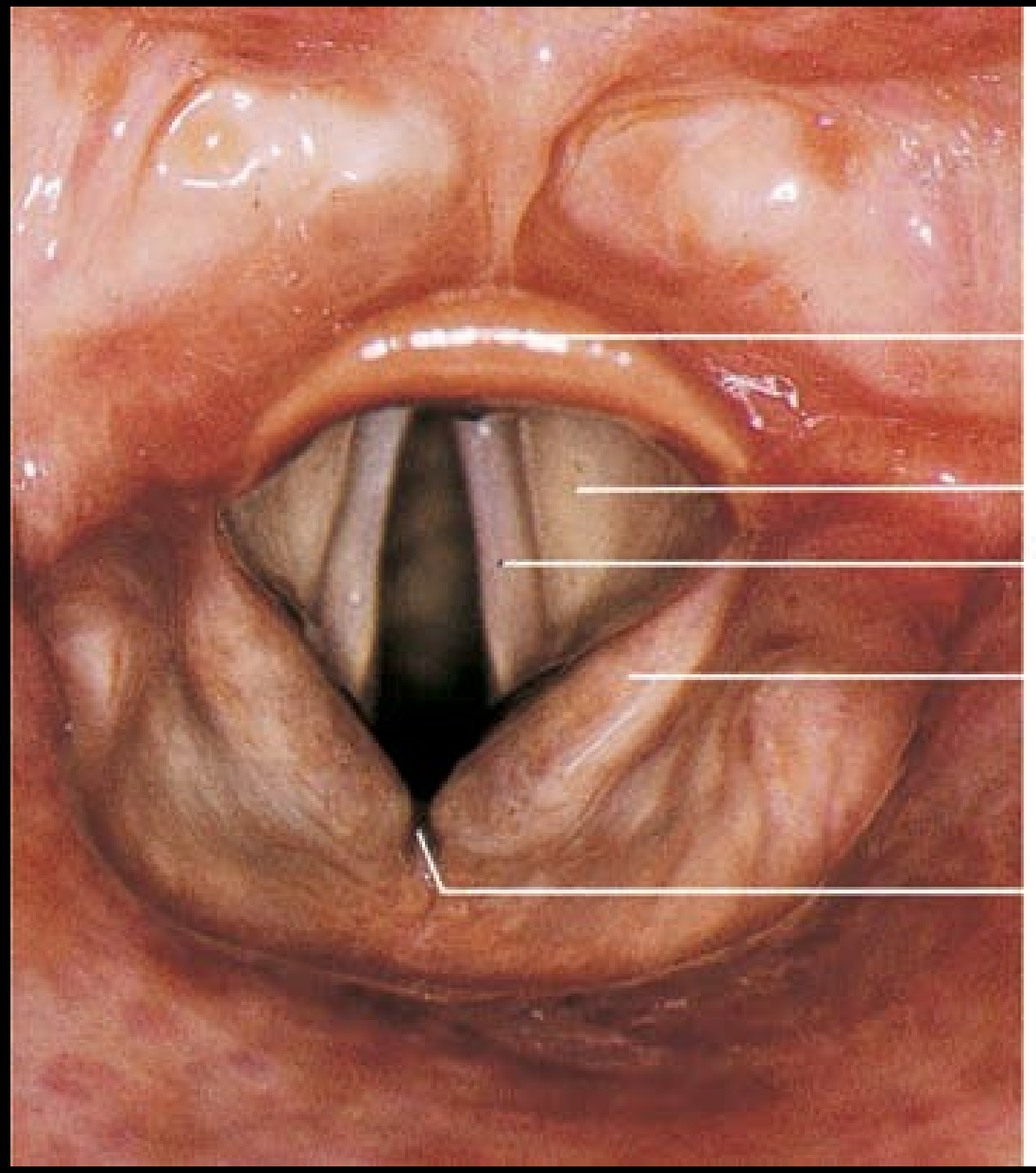
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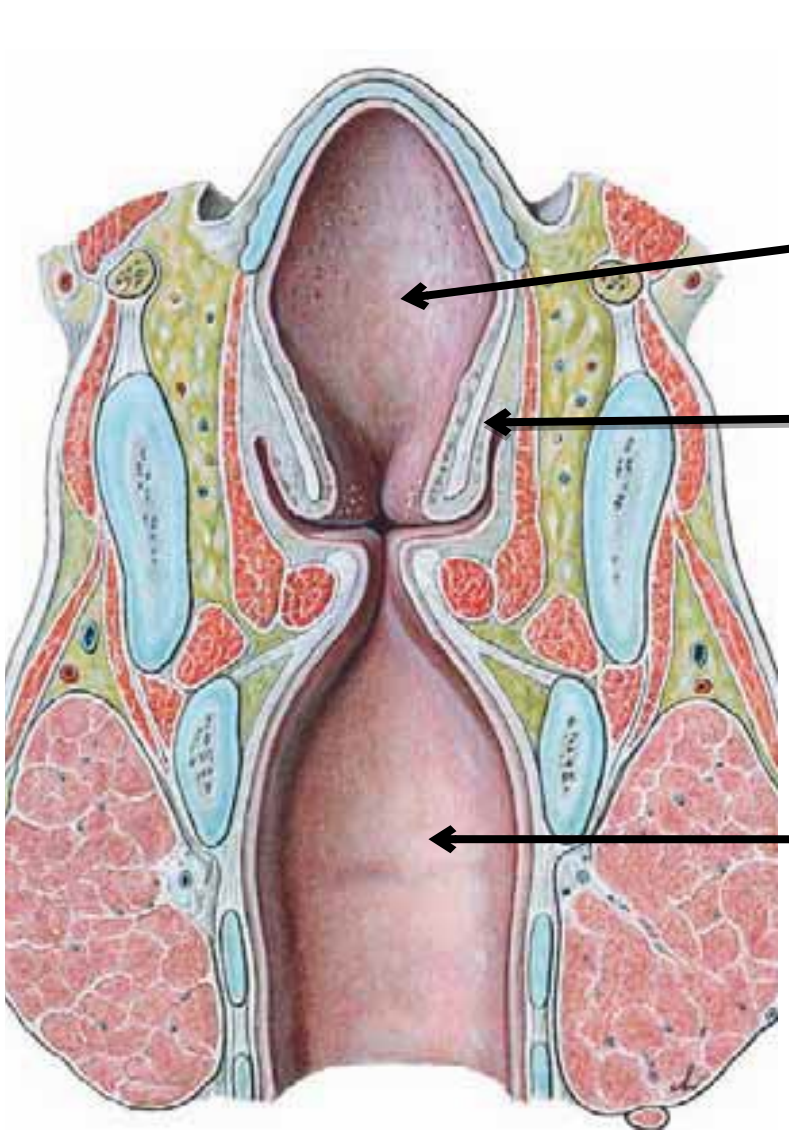
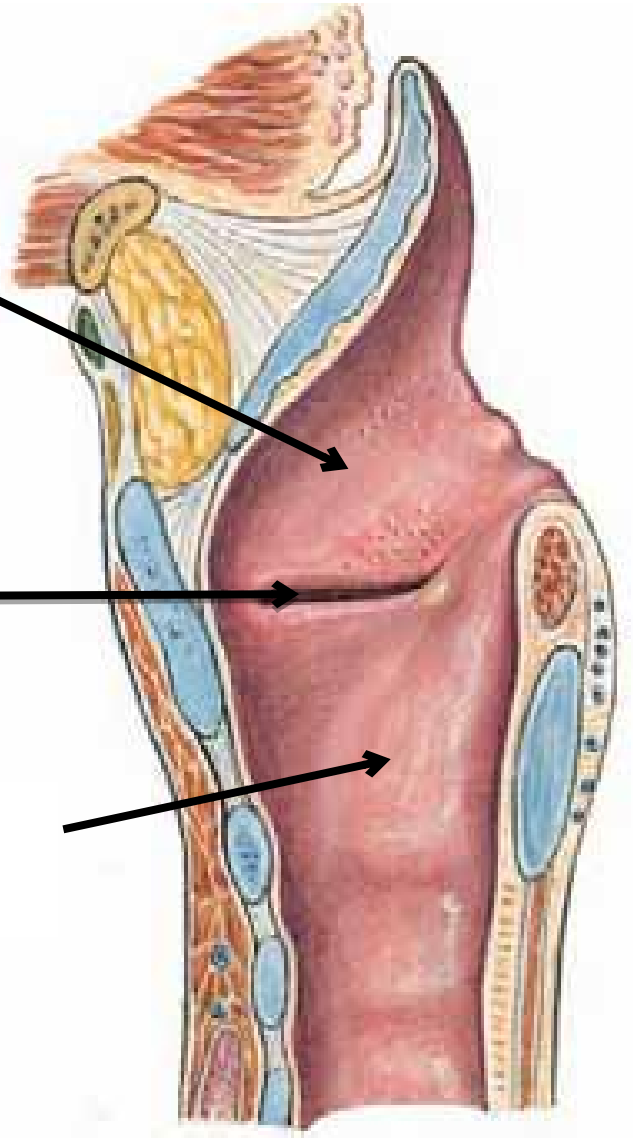


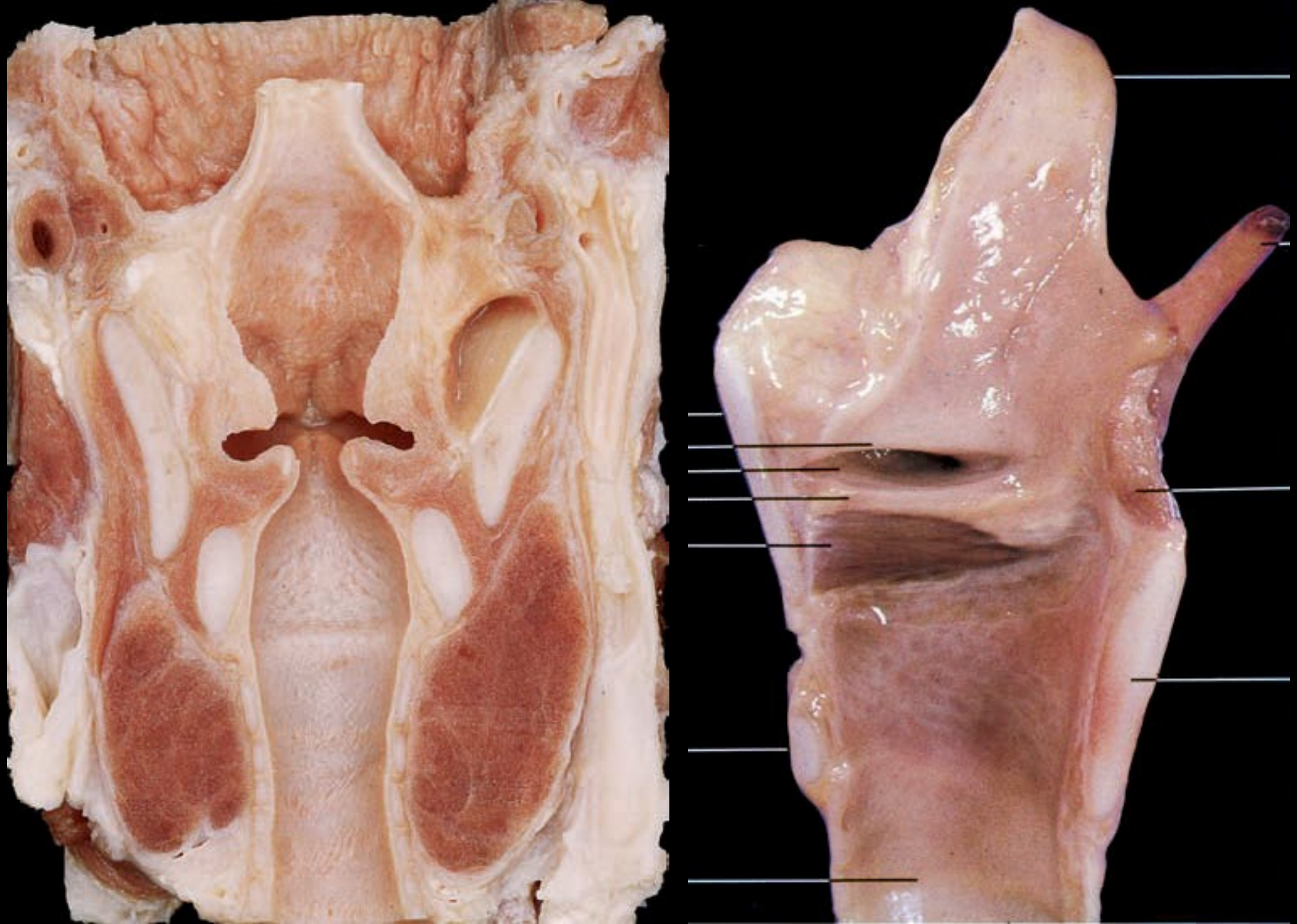
The Vestibule

laryngeal saccule

laryngeal ventricle

Infraglottic Space



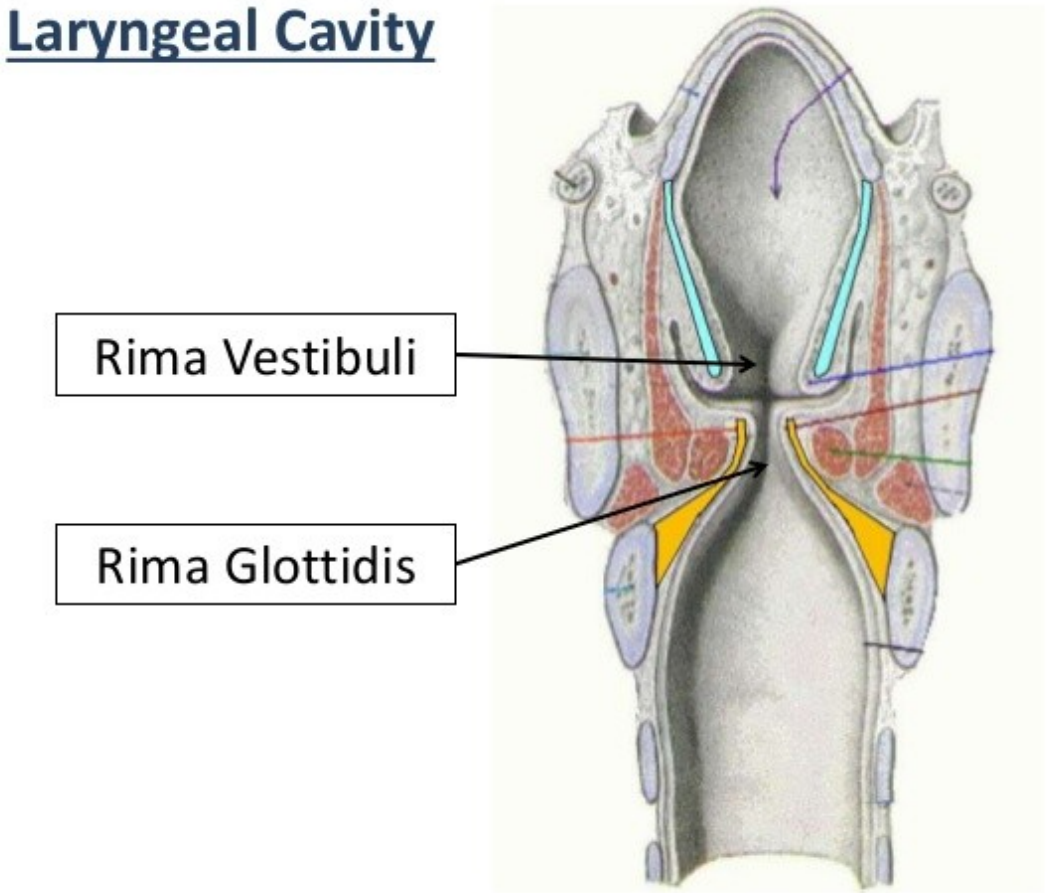


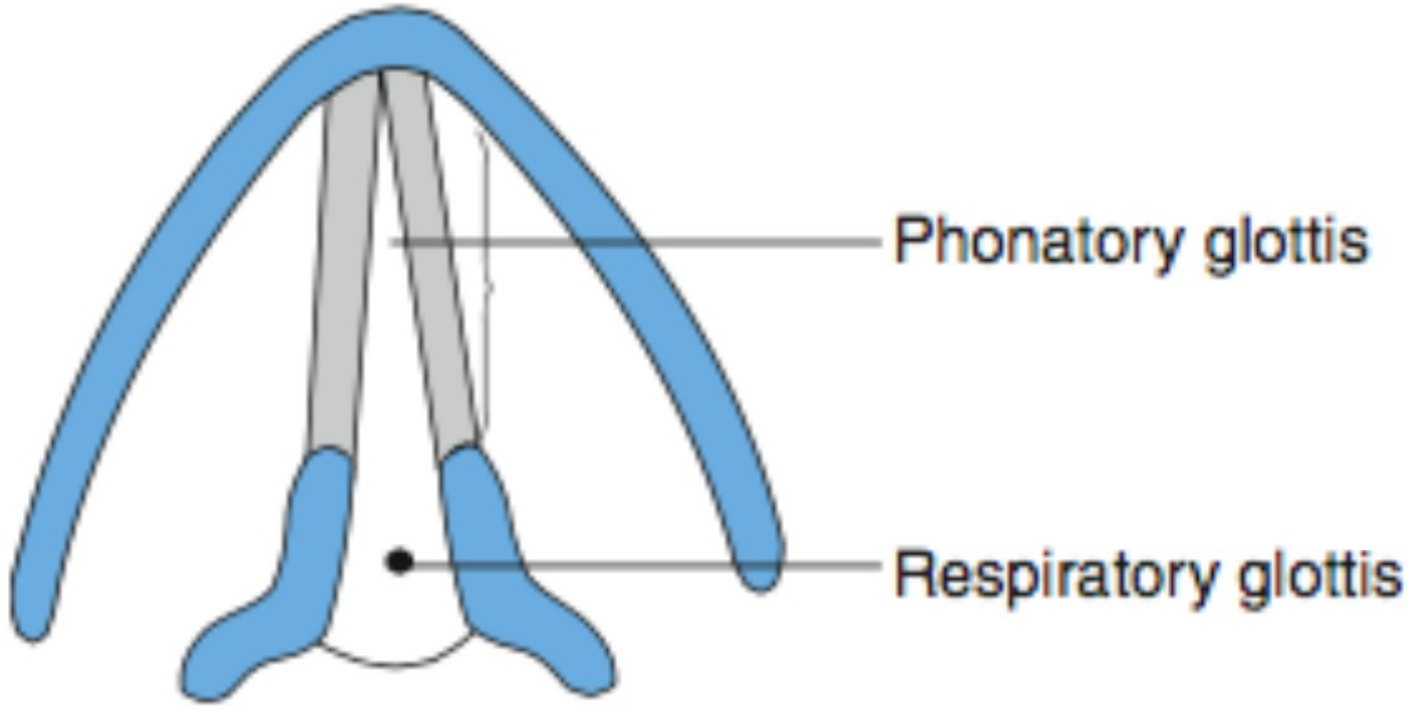
Inspection of the Larynx

Rima glottides (Glottis): ***It is the narrowest part of laryngeal cavity. It is bounded between the 2 Vocal folds***

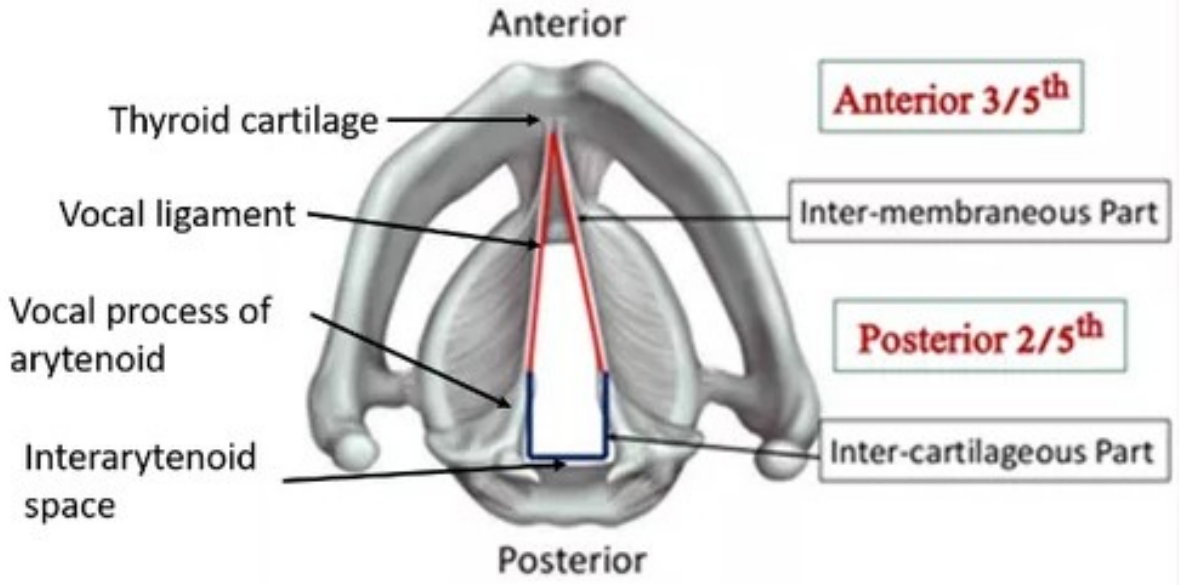
- Narrowest part of larynx
- 23mm in males , 16mm in females
- Anterior part intermembranous
- Posterior part intercartilagenous

Rima Vestibuli: ***it is a triangular-shaped opening between the two adjacent vestibular folds***





Rima Glottidis



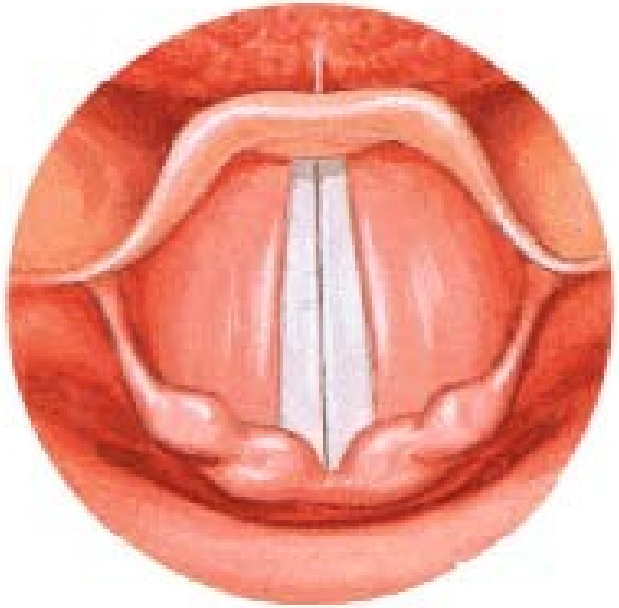
Muscles of the Larynx

- ***They connect different cartilages together***
- **Their actions are :**

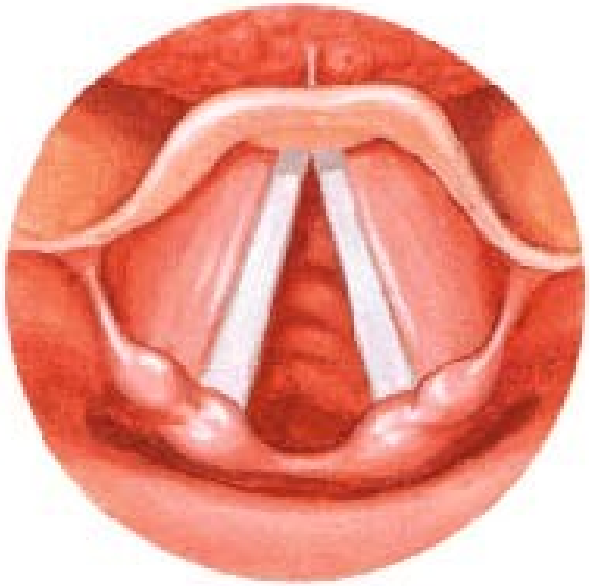
1. Adjust tension in the vocal ligaments,
2. Open and close the rima glottidis,
3. Control dimensions of the vestibule,
4. Facilitate closing of the laryngeal inlet.

Movements of the Vocal Cords

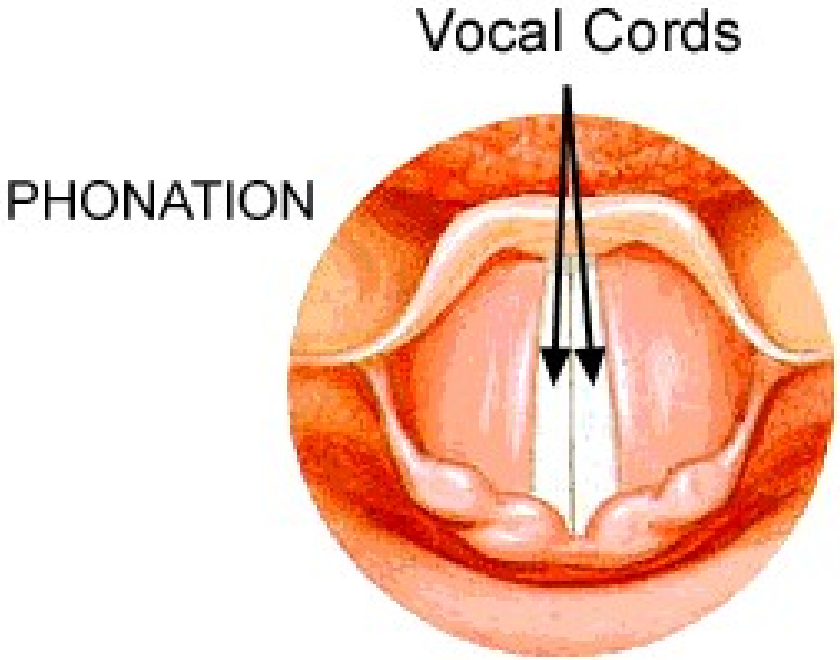
- Adduction
- Abduction



Folds closed (adducted)

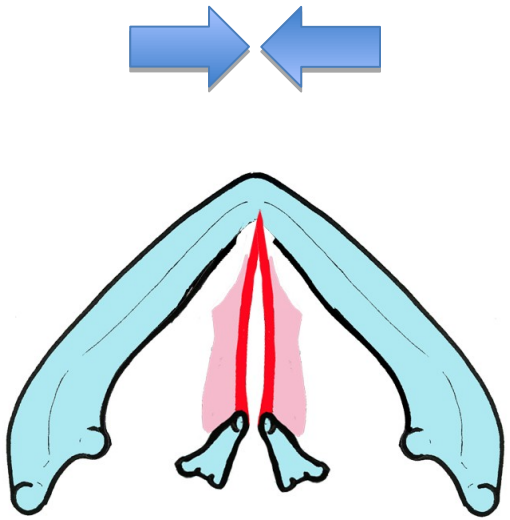


Folds open (abducted)



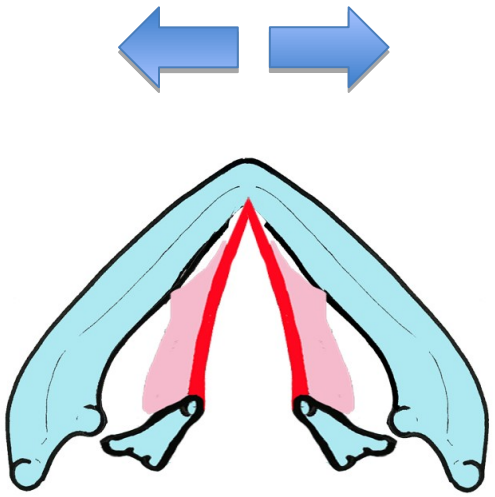
Glottis (space between folds)

Movements of Arytenoids



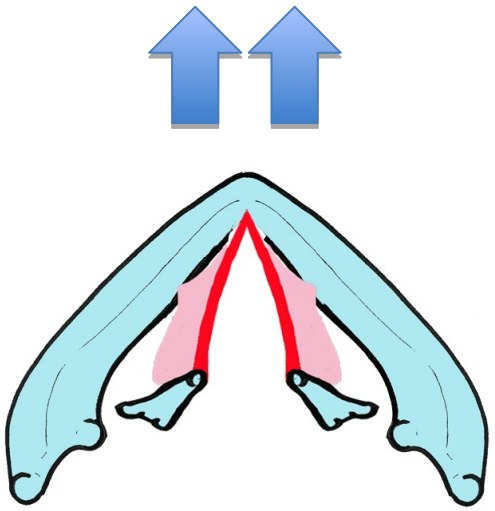
Adduction

Oblique + Transverse Arytenoids + lateral



Abduction

Posterior Cricoarytenoids



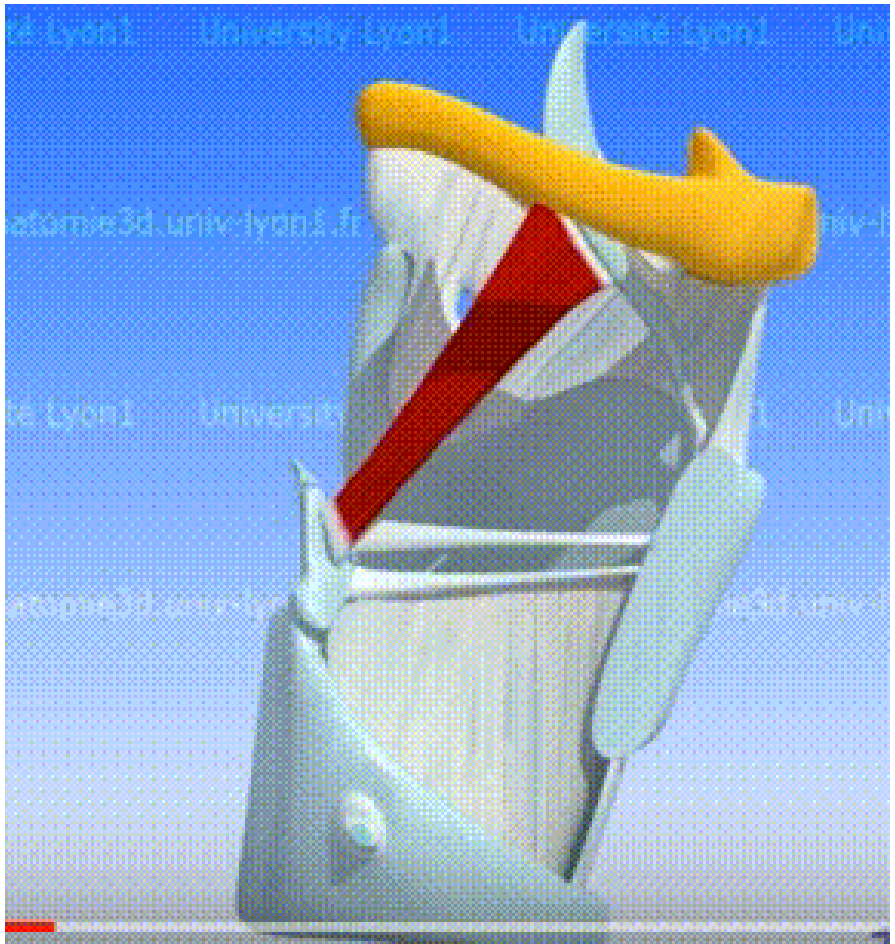
Anterior glide

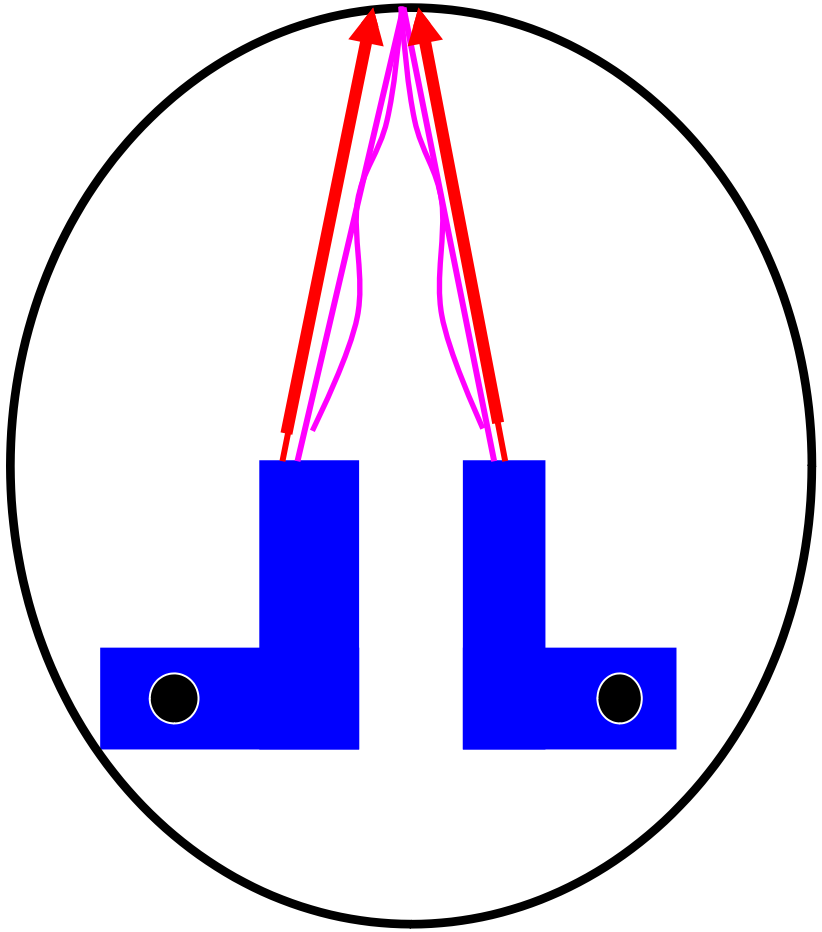
Thyroarytenoids

Thyro-arytenoid Muscle

- **A- Aryepiglottic muscle close the inlet**

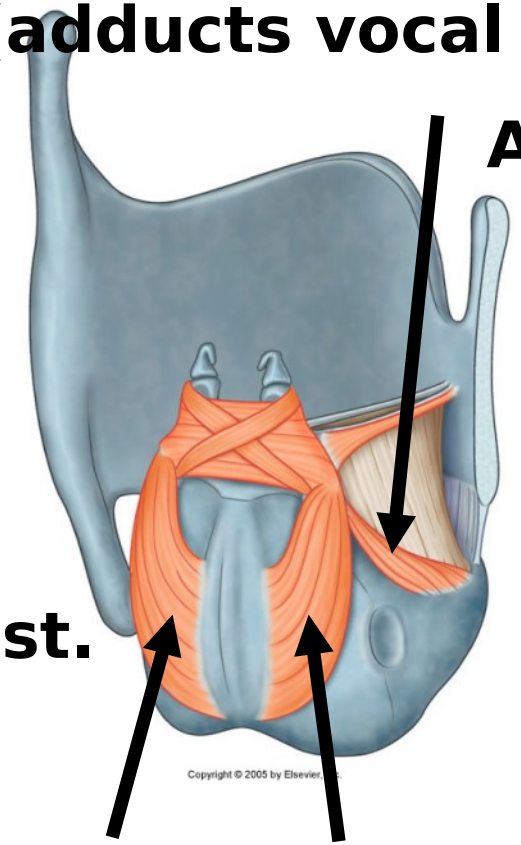
- **B- Thyro-arytenoid muscle relaxes the vocal folds resulting in a softer voice**



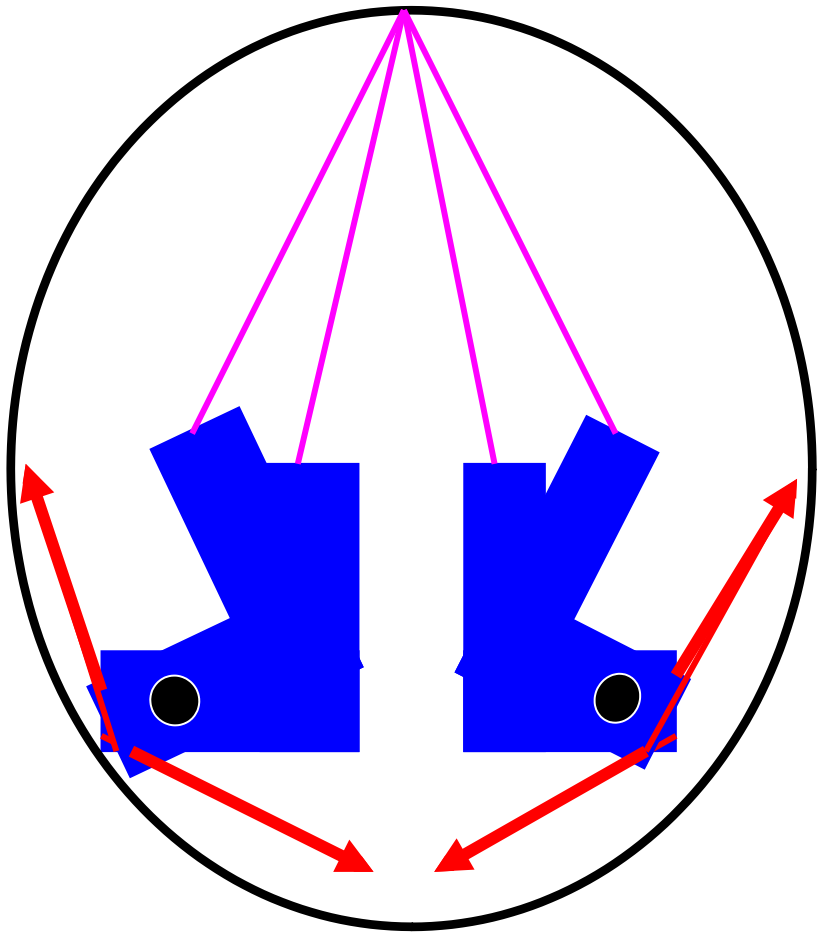


Abduction of cord

Lateral cricoarytenoid muscle
(adducts vocal ligaments)



Posterior cricoarytenoid muscle
(abducts vocal ligaments)



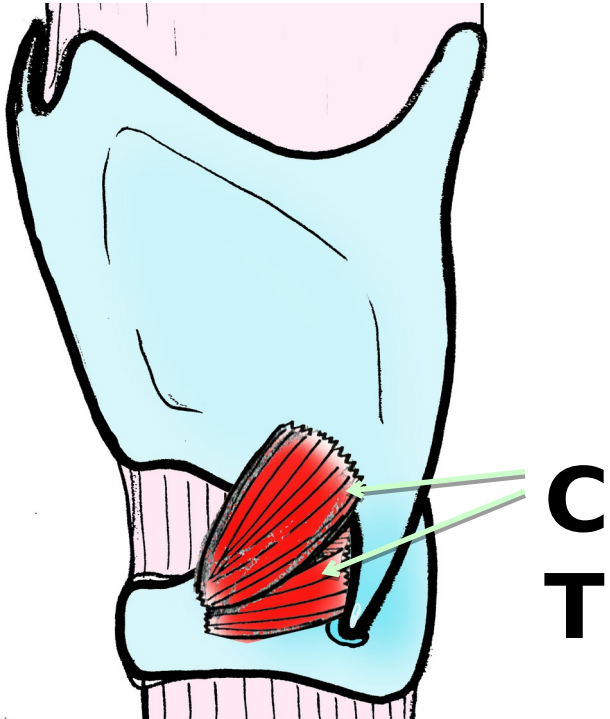
Adduction of cord

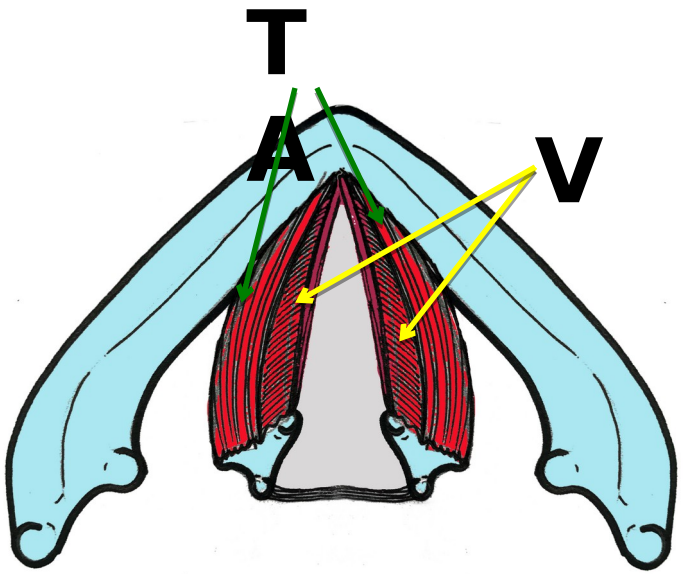
Oblique arytenoids + transverse arytenoid + lateral cricoarytenoid muscles

Muscles of the Larynx

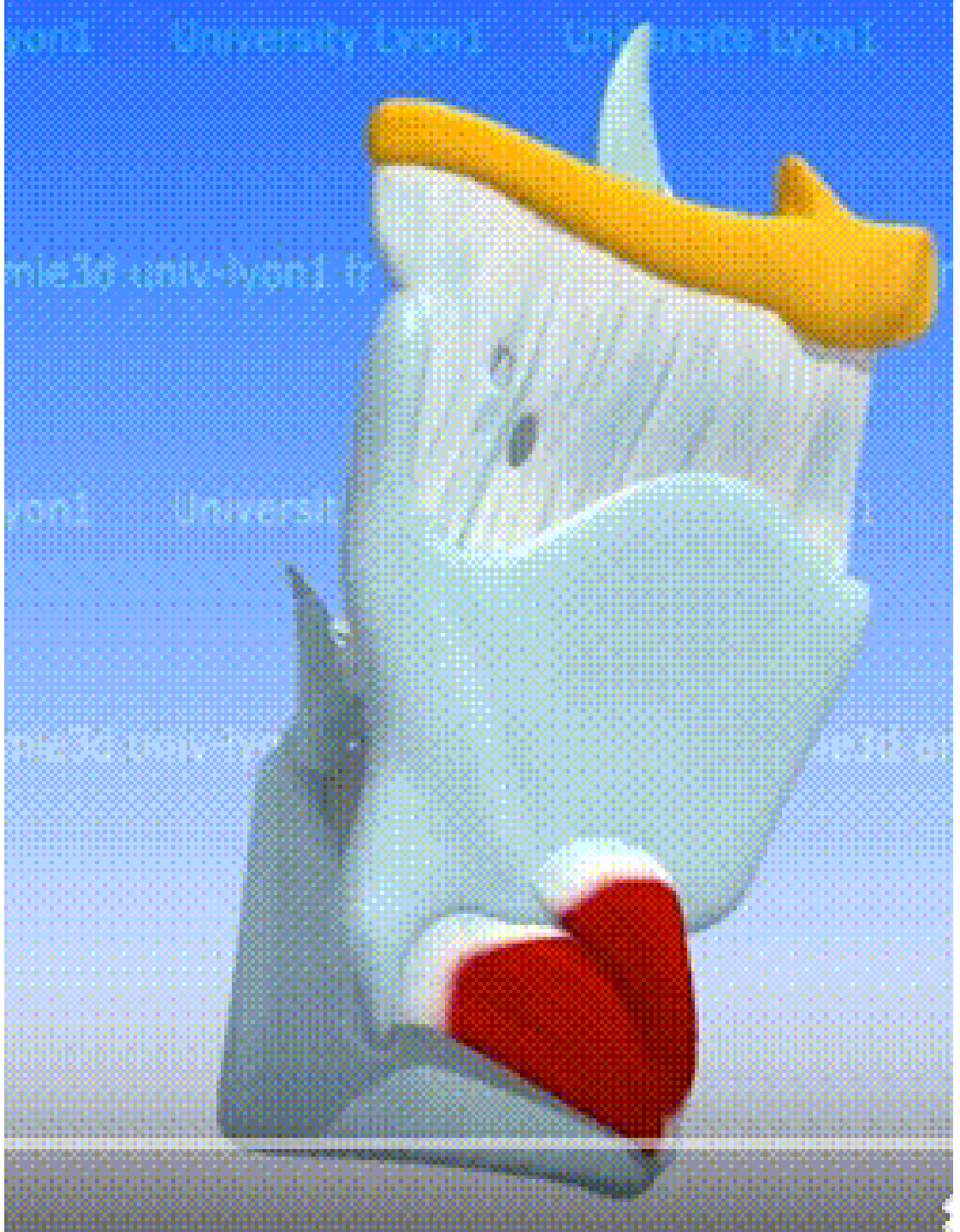
Thyroarytenoid (TA) – pulls arytenoids anteriorly – relaxing cords (*lower pitch*)

Cricothyoids (CT) tilts cricoid up/down against thyroid cartilage tensioning the cords (*higher pitch*)





Cricothyroid



Nerve Supply of the Larynx

Motor supply:

- **ALL** laryngeal ms. → by **recurrent laryngeal n**
  Except ***cricothyroid*** →by **external laryngeal n**

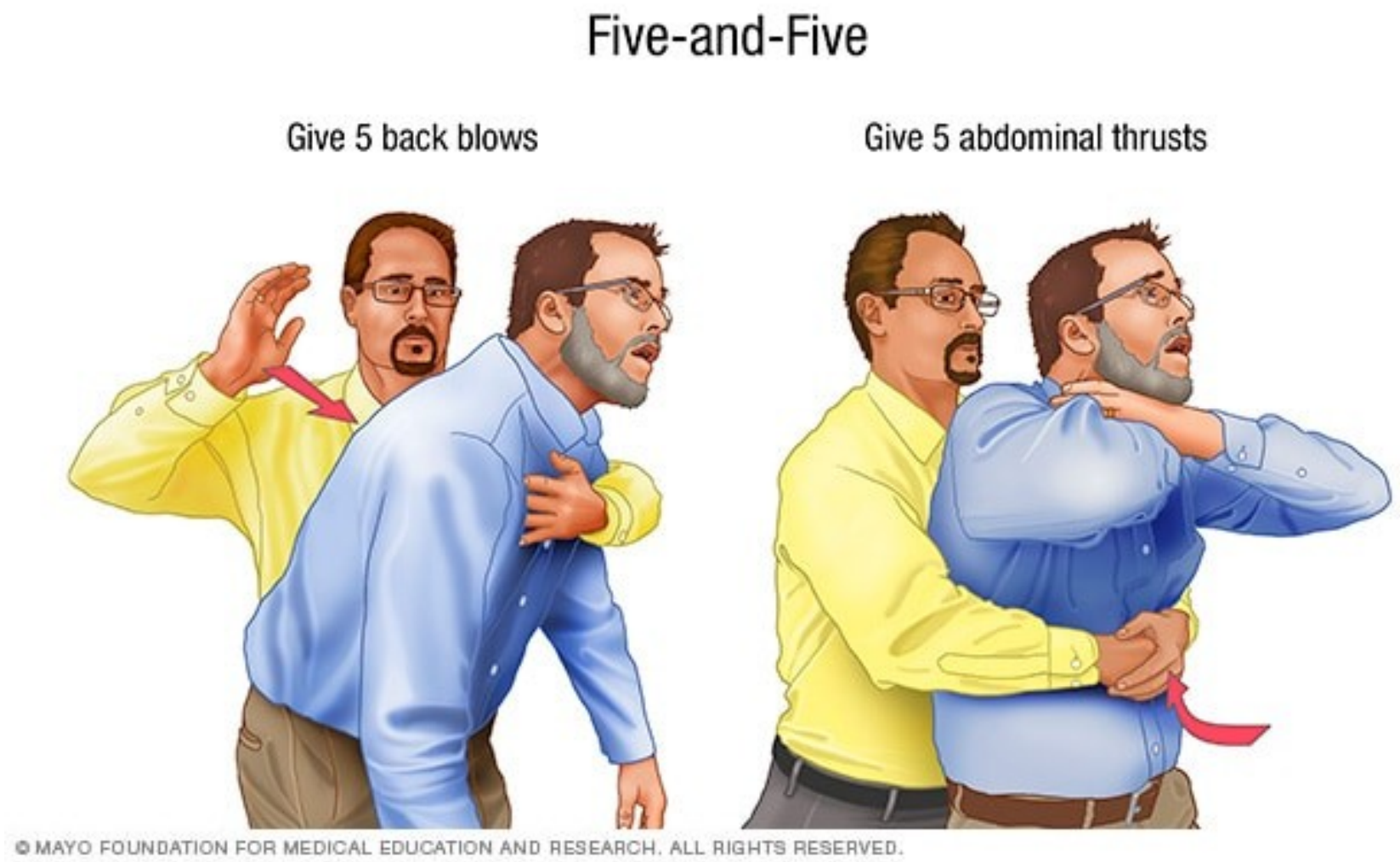
Sensory supply:

- The mucosa **Above Vocal Cords** is supplied by **Internal Laryngeal Nerve**
- The mucosa **Below Vocal Cords** is supplied by **Recurrent Laryngeal Nerve.**

Heimlich Maneuver

What happen if a foreign body accidently enters larynx ?

Heimlich Maneuver

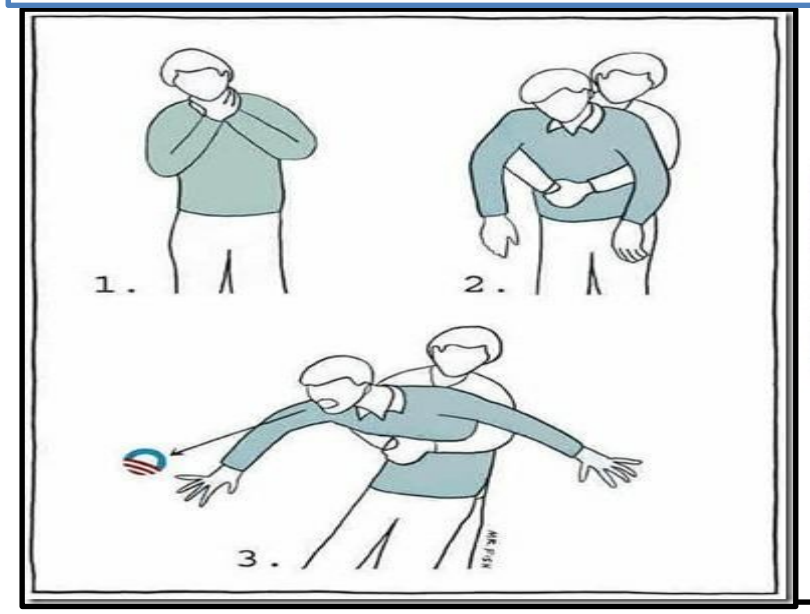


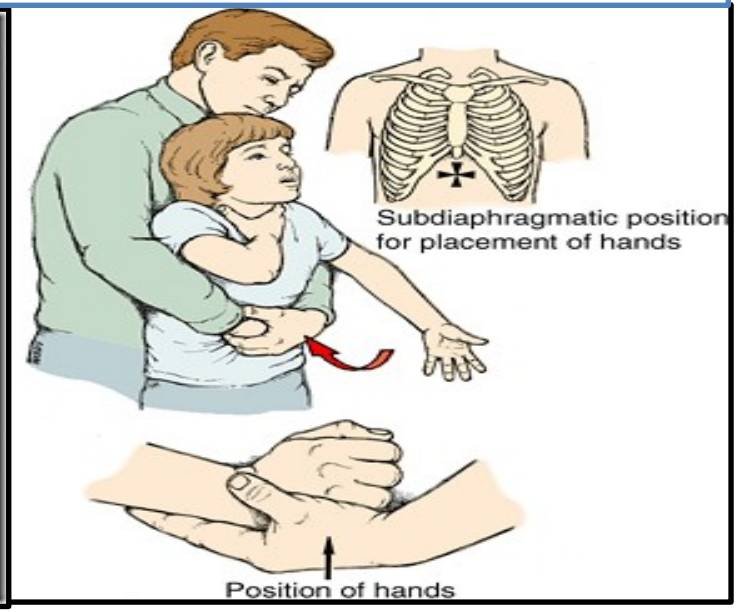
Different Procedures for Removing Foreign Bodies in Adults and Children

All maneuvers are directed toward the increase in intra-thoracic pressure to expel the foreign body from the airway.

(Heimlich maneuver)

children older than 1 year and for adults





Children younger than 1 year

Emergency Cricothyroidotomy
and its tools

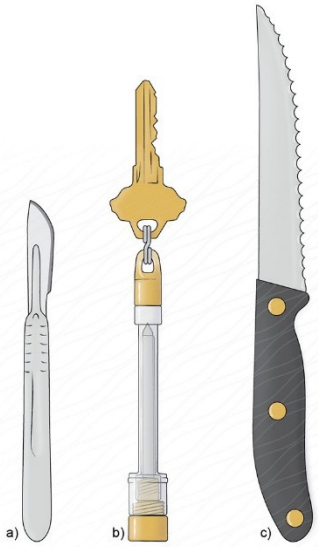


Fig. 1 Devices available for performing a laryngotomy:
a) Scalpel blade 22 b) Percutaneous key-ring device c) Steak knife

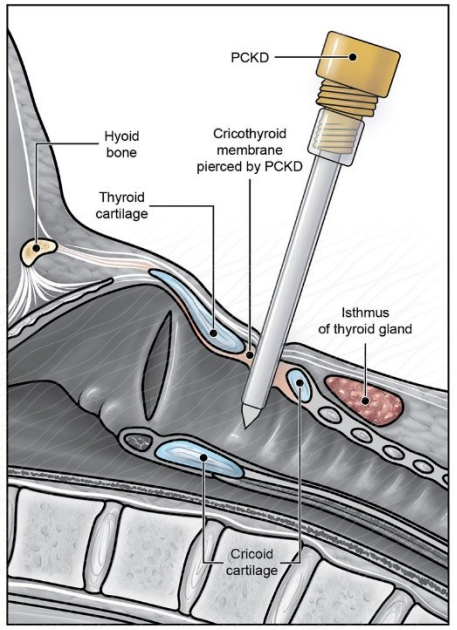
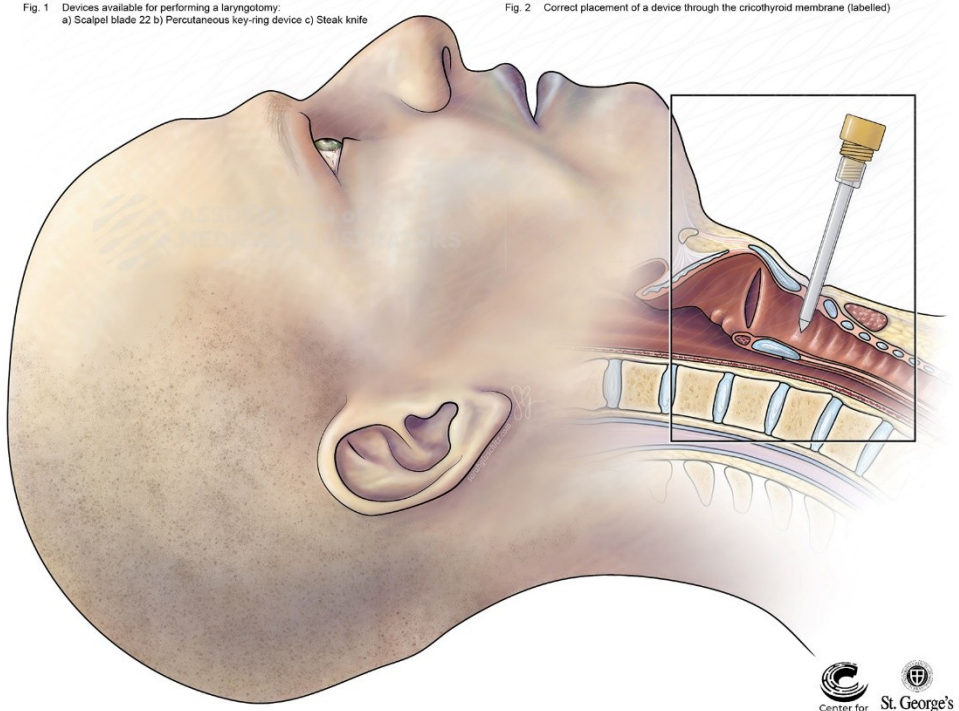


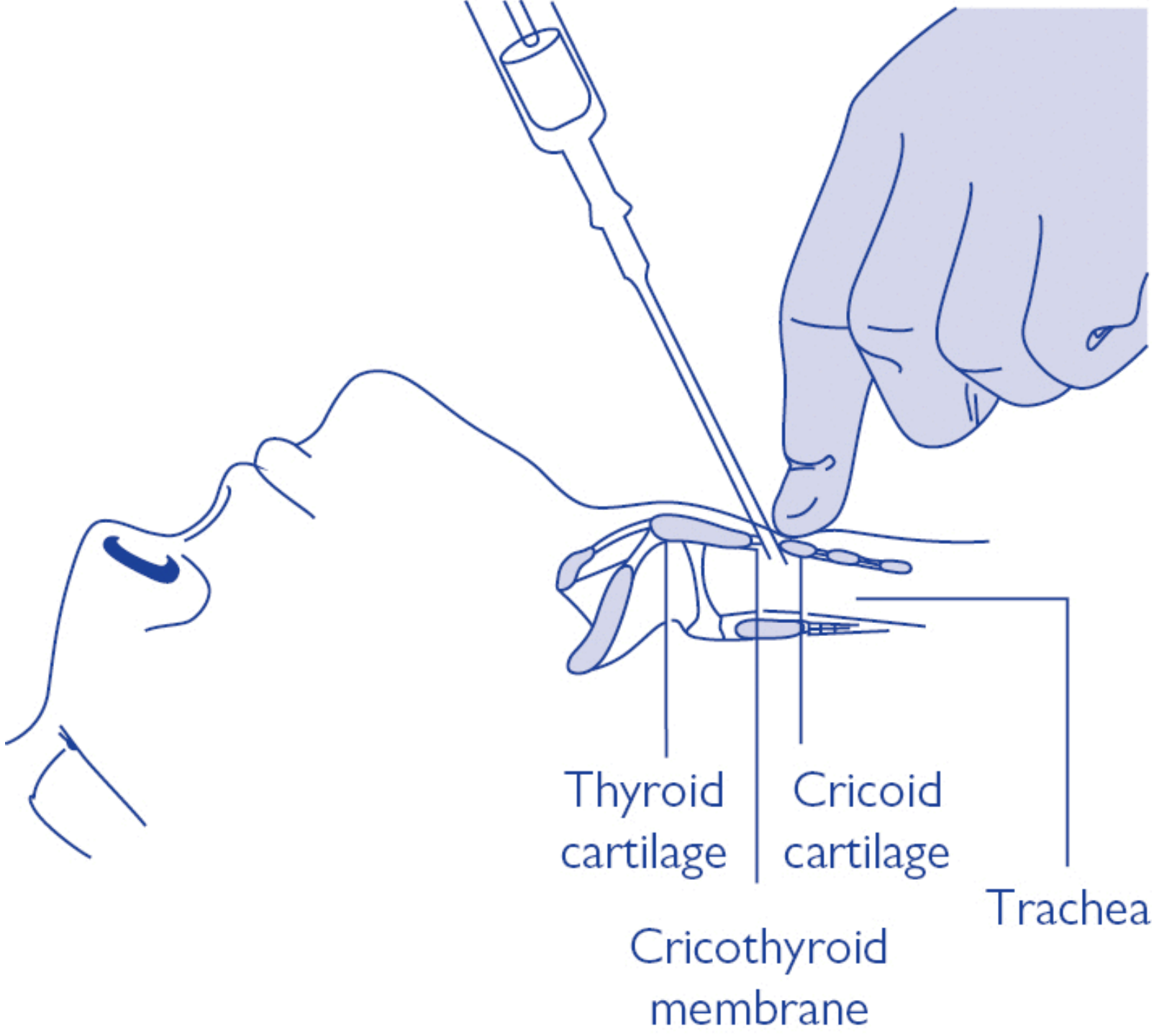
Fig. 2 Correct placement of a device through the cricothyroid membrane (labelled)



Center for BioMedical Visualization

St. George's University

Fig. 3 Midline sagittal section of neck highlighting correct placement of a device through the cricothyroid membrane


Thyroid cartilage
Cricoid cartilage
Trachea
Cricothyroid membrane

SUGGESTED TEXTBOOKS

- Clinical Anatomy for Medical Students. Richard S. Snell

- Gray’s anatomy for students .

- **For further inquiries *PLZ* feel free to contact at any time through email**

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Thank You